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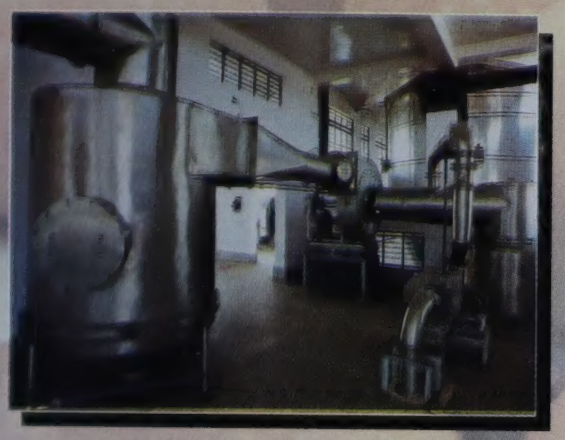

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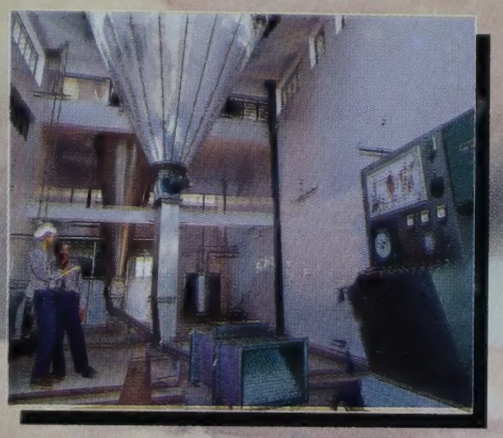

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• Food & Food Processing • Dairy • Agri Business & Agro Products • Bakery • Beverages, Confectionery & Grocery.

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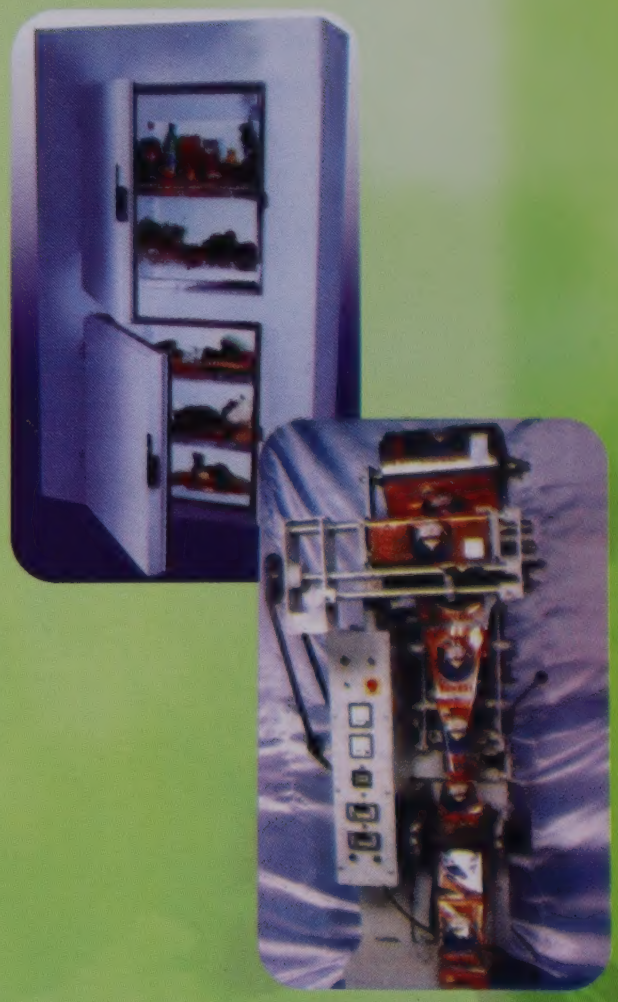

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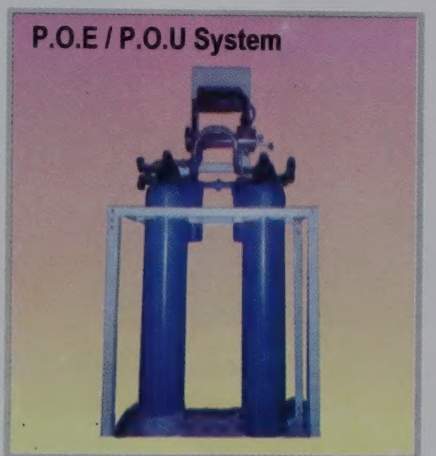
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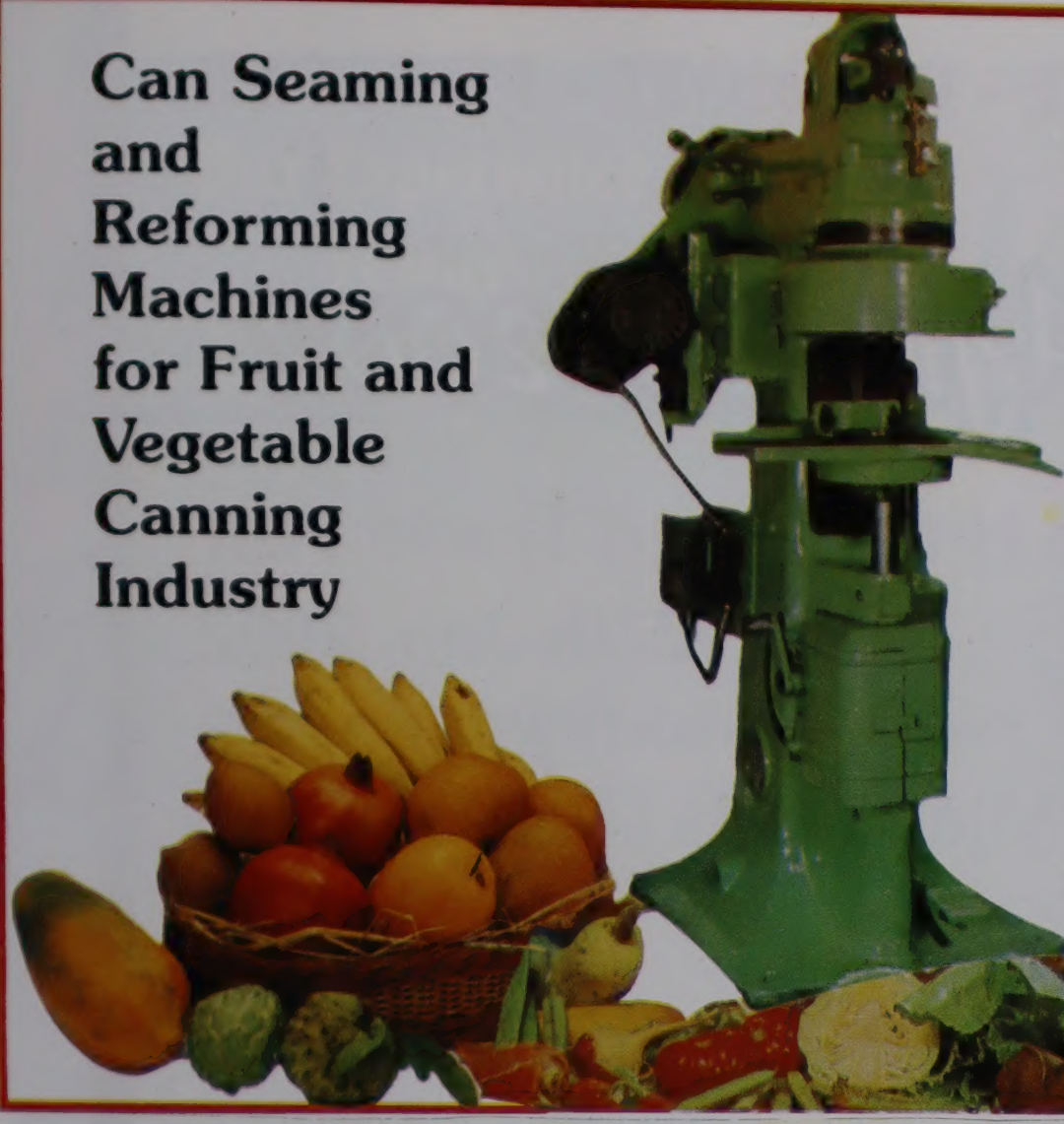

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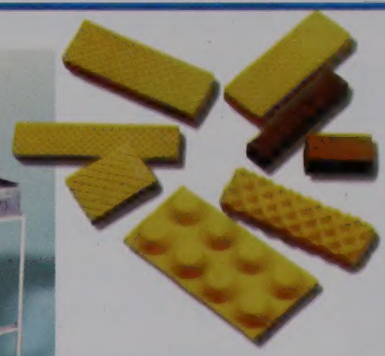

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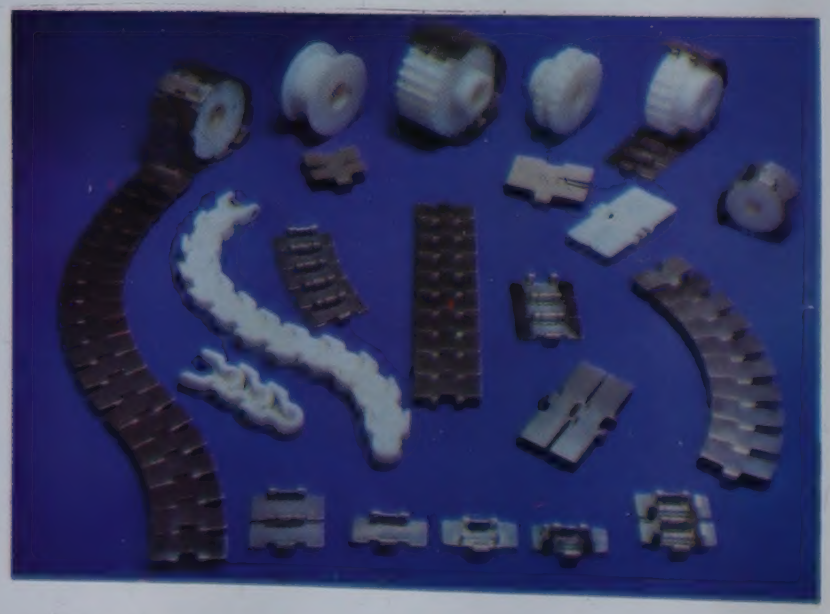

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CONTENTS

Editorial...

Milk has always been a generic product, like bread or water. Traditionally, dairies were local icons and their products were viewed as being both natural and necessary. But the world has changed. National borders have disappeared, markets are oversupplied, and consumers have turned into individuals no longer loyal. Competition is the name of the game. Consequently, the brand, and the values it carries, has become the truly critical competitive factor.

Though the country has emerged as the world's largest milk producer, growing at 4.5 percent since the early 1970s, an export outlet will be essential to sustain that kind of high growth. Quality and hygiene aspects of milk & milk products will have to conform to the globally–accepted Codex Alimentarius Commission standards.

The infrastructure for collection of milk, its preliminary milking and processing at village level, cold stores and refrigerated transportation needs to be modernised and augmented to ensure hygienic handling of milk and its products.

Dairy producers are turning to UHT process plants which use direct heating instead of the indirect UHT system popular in past times. The direct steam injection UHT process system adds instant heat to the final sterilising temperature and has a short holding time and instant flash cooling, thus providing the lowest possible heat degradation to the product, while ensuring sterilising efficiency.

World milk production declined by two percent during the last three years, but is projected to rise by about two percent this year to touch the 585 million tonne mark. Indian production is estimated by the FAO to have increased by four percent and will scale a new high of 81 million tonne, according to the projections released by the United Nations Food and Agriculture Organisation (FAO). Interestingly, the annual yield per cow in India is 520 litres compared to 9291 litres in Israel and 7067 litres in the USA. India targets an increase to 3000 litres per cow by 2020.

The production of processed milk products is growing.

Looking to the future, a number of developments are expected. Improved breeding technologies and animal healthcare are expected to increase milk yield levels, while milk quality is to be improved by the widespread use of farm bulk coolers, the introduction of milk testers and enzymatic protection. Milk processing is to be improved through the better usage of primary processing technologies such as refrigerated chilling centres and compact milk chilling units, the use of ultra high temperature and extended shelf life treatments, and the introduction of aseptic packaging.

The future will also see increased production of processed milk products such as cheese, weaning foods, yoghurt, lactose and caseinates.

✍ **Editor**

Traditional Dairy Products of India

by
Champak Palit

Introduction

Since time immemorial, a significant proportion of milk has been converted, in India, to a wide variety of milk delicacies – an unending array of sweets and other specialities from different regions of the country that are a gourmet's delight. It is estimated that nearly half of the 74 million tons of milk produced in India is utilised for the manufacture of a variety of traditional milk products viz.; *Ghee, Khoa, Chhana, Srikhand, Paneer, Dahi, Rabri* and numerous other delicacies. This is because the consumption and distribution of sweets on festive and other joyful occasions is a traditional feature of Indian culture. In the process, the basic limitation of milk – its perishable nature – has been tastefully overcome, because its processing also aims to extend the shelf-life of milk and convert it into mouth watering delicacies.

Classification of Indian Dairy products

Indian Dairy Products can be broadly classified into seven different groups.

- **Heat desiccated/concentrated whole milk products:** Khoa, Basundi, Rabri, Khurchan
- **Fermented/Coagulated milk products:** Dahi/Misti Dahi, Chakka/Srikhand.
- **Heat and Acid coagulated milk products:** Chhana, Paneer
- **Fat rich products:** Makkhan, Ghee
- **Frozen products:** Kulfi/Malai-ka-baraf
- **Milk-cereal mixes:** Kheer, Payasam, Phirni, Mihidana
- **Others:** Lassi/Chhas/Matha, Ghee residue

Among the above mentioned products, the largely consumed ones are

Khoa and Chhana : the base material for most of the traditional sweetmeats

Paneer : used in the preparation of a large number of culinary dishes

Ghee : used for direct consumption or as a cooking/frying medium

Dahi : consumed directly or used in the preparation of Srikhand.

Heat – desiccated/concentrated products

Khoa

It is prepared by partial dehydration of milk in an open pan while constantly stirring cum scrapping till it reaches a semi solid consistency (usually 65 - 72% total solids). It is the base material for variety of popular sweet-meats particularly Burfi, Peda, Gulabjamun etc. There are three main varieties of Khoa viz., Pindi, Danedar and Dhap, Pindi having the highest solids and Dhap the least.

Composition of Khoa

	Moisture (%)	Fat (%)	Protein (%)	Lactose (%)	Ash (%)	Iron (ppm)
Cow Milk	25.6	25.7	19.2	25.5	3.8	103
Buffalo Milk	19.2	37.1	17.8	22.1	3.6	101

(De, 1990)

Some Khoa based sweets

Different varieties of Burfi	Carrot-halwa
Peda	Gourd-halwa
Kalakand	Malai Laddoo
Milk-cake	Gujhia
Gulabjamun	Malpo

Burfi

Khoa, preferably Pindi type, is mixed with 25-30% sugar at about 80°C. The whole mixture is kneaded and whipped by vigorous beating during the mixing process to get a smooth homogenous mass. The mass is then hot poured into shallow pre-greased trays. allowed to cool to room temperature and cut into small pieces of desired shape and size. Nuts, flavouring or other additives may be added during the kneading process.

Composition of Burfi

Moisture(%)	Fat(%)	Protein(%)	Lactose(%)	Sucrose(%)	Ash(%)
15.64	20.37	15.05	15.81	30.41	2.72

(Palit, 1998)

Peda

The manufacturing process is similar to that of Burfi. Peda contains less moisture as compared to Burfi and, therefore, possesses a dry body and granular texture.

Composition of Peda

Moisture(%)	Fat(%)	Protein(%)	Lactose(%)	Sucrose(%)	Ash(%)
10.44	19.9	18.3	18.72	30.4	2.24

(Pal, 1998)

Gulabjamun

This Khoa based sweet is popular all over India. The product is characterised by brown coloured spherical and smooth shape, soft and slightly spongy body free from lumps and hard core, uniform granular texture, milk evoked and oily flavour, cooked-free from doughy feel and fully succulent with sugar syrup. The product is prepared by mixing Dhap Khoa and maida (4:1) to a smooth homogeneous dough. Small amount of baking powder is also added to the dough. The dough is then rolled into balls, deep fried in ghee to golden brown colour and then transferred to hot sugar syrup (60°C) for at least 2 hours.

Composition of Gulabjamun

Moisture (%)	Fat (%)	Protein (%)	Ash (%)	Total carbohydrates
25 – 35	8.5 – 10.5	6.0 – 7.6	0.9 – 7.6	43 – 48

(Pal, 1998)

Kalakand

The product is similar to Burfi except that it has big hard grains, distinct cooked flavour and brown colour. Usually Danedar type of Khoa is used in its preparation. Citric acid@0.01% of the milk, can be added to the milk after the first boil during the manufacturing process of this product to get the desired grains.

Basundi

It is a partially concentrated sweetened whole milk product mostly popular in western parts of the country.

Milk is concentrated two-fold in an open pan by slow boiling. The heat coagulated mass formed on the surface is intermittently stirred back into the milk that provide typical soft textured flakes which remains uniformly suspended in thickened milk. Sugar @ 6-7% is added at the last stage of concentration. Addition of nuts and flavourings are optional. The product is served chilled.

Composition of Basundi

Fat (%)	SNF (%)	Sucrose (%)
18 – 22	28 – 32	20 – 22

(Aneja, 1997)

Rabri

This is a concentrated and sweetened whole milk product that contains several layers of clotted cream. During the concentration of milk in an open pan at simmering temperature, the skin which forms on the surface are broken up and moved to the cooler parts of the pan. When the volume of the milk reduces to about one-fourth of its original volume, sugar @

Officer (Q.A.), Mother Dairy, Gandhinagar 382 428

5-6 % of milk is added to it, the clotted cream layer is immersed in the mixture and heating continues for few more minutes till the sugar dissolves completely.

Composition of Rabri

Moisture(%)	Fat(%)	Protein(%)	Lactose(%)	Sucrose(%)	Ash(%)
30	20	10	17	20	3

(Srinivasan & Anantakrisnan, 1964)

Khurchan

This product is manufactured almost in a similar way to that of Rabri except that the skin which forms on the surface during simmering is not broken. In fact, the milk is not stirred till sugar is admixed.

Composition of Khurchan

Moisture (%)	Fat (%)	Protein (%)	Lactose (%)	Sucrose (%)	Ash (%)	Iron (mg%)
27.9	23.6	15.4	14.9	15.2	3.0	25.3

(Gupta & Rao, 1972)

Heat and acid coagulated products

Chhana/Paneer

Chhana is the base material for a variety of sweet-meats produced in the eastern part of India. Whole milk, preferably cowmilk, is brought to boil. The heating is then stopped and coagulating agent such as lactic / citric acid (1-2% solution) or good quality sour Chhana whey of previous batch is added after slightly cooling the milk (usually at 80°C). The milk is slowly stirred while the coagulant is being added. When the coagulation is complete (as indicated by the clear whey), the contents are poured over muslin cloth to remove the whey. The cloth containing the coagulum is then hung on a peg without applying pressure to drain the free whey.

Composition of Chhana

	Moisture (%)	Fat (%)	Protein (%)	Lactose (%)	Ash (%)
Cow Milk (4.5%F, 13% TS)	53.4	24.8	17.4	2.1	2.1
Buffalo Milk (8.4%F, 17.9%TS)	51.6	29.6	14.4	2.3	2.3

(Ray & De, 1953)

In Paneer manufacturing, the coagulum is obtained as above after coagulation of milk. The coagulated mass is then filled in wooden hoops with cloth linings and then pressed for 30 minutes with heavy iron weights. The pressed block of paneer is then removed from the hoop, cut into smaller blocks and immersed in chilled water (4-5°C) for 2-3 hours to make it firm. Then they are removed from the chilled water, excess water wiped off with a clean cloth, cut into desired size, packed and kept refrigerated till use.

Composition of Paneer

Moisture (%)	Fat (%)
54.74	26

(De, 1990)

Some Chhana based sweets

Rasogolla	Rajbhog
Sandesh	Seetabhog
Pantooa	Chhana-murki
Ras-malai	Chhana-Kheer
Cham-cham	Lalmohan

Rasogolla

It is one of the most popular traditional Indian milk sweet prepared from Chhana. Chhana is kneaded to smooth doughy consistency. Spherical balls are then made by rolling in hand These Chhana balls are then cooked in boiling sugar syrup (60%) for about 25-30 minutes. The Rasogolla balls are then transferred to hot sugar syrup (60°C) having 40% strength.

Composition of Rasogolla

	Moisture (%)	Fat (%)	Protein (%)	Sugar (%)	Ash (%)
Cow	50	5.1	6.2	37.7	1.0
Buffalo	52.8	4.2	6.4	36.1	0.5

(Verma, 1998)

Sandesh

It is another popular Chhana based sweet. Ground sugar @ 30% is mixed with Chhana (preferably kneaded to smooth paste). The mixture is heated on a slow fire with continuous stirring cum scrapping. When patting stage has been reached (mixture forms balls), it is poured in trays and cooled, cut into desired shape and sizes. Alternatively, the mass can be moulded in different shapes and sizes. Addition of flavourings, cardamom etc., at the end of the heating process, is optional.

Composition of Sandesh

	Moisture (%)	Fat (%)	Protein (%)	Sugar (%)	Ash (%)
Cow	25.5	19.89	18.48	34.47	1.66
Buffalo	27.14	18.42	18.71	33.83	1.9

(Verma, 1998)

Cham cham

It is another popular Chhana based sweet of eastern India particularly, West Bengal. The product is almost similar to Rasogolla except its cylindrical shape. A delicacy of this sweet is prepared by smearing grated khoa or coconut powder.

Fat – rich products

Makkhan

It is the Indian counterpart of western butter. Whole buffalo milk (or mixed milk) is brought to the first boil, cooled to room temperature, inoculated with lactic culture or good quality sour butter milk (lassi) and incubated for 24 hours. The curd formed is then churned with crude indigenous wooden devices (improved metal churn is also available now-a-days). During churning cold water is added intermittently to wash the butter grains. When the churning is over, the Makkhan (accumulated butter grains) is then removed by perforated wooden scoop.

Composition of Makkhan

Moisture (%)	Milk Fat (%)	Non-fatty solids (%)
18 – 20	78 – 81	1.0 – 1.5

(De, 1990)

Ghee

It is the most popular of all the Indian Dairy products. In the country method, it is usually made from Makkhan. Ghee is the purified milk fat almost free from any other milk constituents. In desi method, Makkhan is heated and stirred in an open pan on a low fire to remove the moisture. When practically all the moisture gets evaporated, the heating is stopped and the pan contents allowed to cool. The residue then settles down and clear fat decanted from the vessel to suitable containers and stored. (Several modern technologies have been developed for Ghee manufacture. Even continuous Ghee making machines are available now-a-days).

Fermented / Coagulated products

Dahi / Misti Dahi

It is a fermented milk product produced and consumed country wide. It is prepared by boiling milk, also concentrating the same to some extent during the process, cooling the milk to body temperature, inoculating the milk with lactic culture or good quality Dahi from previous batch and incubating the same overnight at room temperature to get a firm set curd. The product usually has an acidity of 0.7 to 1.0%.

In eastern India, 6-7% sugar is added to the milk during or before boiling the milk. This product is called Misti Dahi.

Dahi usually has more fat and solids-not-fat content than that of the milk from which it is prepared because of the evaporation of water during boiling.

Chakka / Srikhand

Chakka is the base material for Srikhand. It is obtained by draining the whey from Dahi. In traditional method, Chakka is

made by fermenting the milk with lactic culture similar to the process of Dahi manufacture. The curd is then broken and placed in muslin cloth bags and hung on a peg for removal of whey for 12 – 18 hours. The position of the curd may be altered during the draining process to facilitate whey drainage. The solid mass then obtained is called 'Chakka'.

Composition of Chakka

Total solids (%)	Fat (%)	Protein (%)	Reducing Sugar (%)	Ash (%)	Titrable acidity (%1.a)	pH
22 – 23	Trace	13.5 – 14.0	3 – 3.25	0.95 – 1.08	2.1 – 2.2	4.4 – 4.6

(Patel, 1998)

Chakka is mixed with sugar to yield a semi-soft, sweetish-sour homogeneous product called 'Srikhand'. Addition of color and flavourings is optional.

Composition of Srikhand

Moisture (%)	Fat (%)	Milk Solids not Fat (%)	Sugar (%)
34 – 40	4 – 6	10 – 12	43 – 45

(Aneja *et al.*, 1977; Miyani, 1982; Patel, 1982; Patel and Abd-Salam, 1986)

Frozen products

Kulfi / Malai - ka - Baraf

This product closely resembles ice-cream but has no provision for air incorporation in the product like that in ice-cream. The product is usually made by boiling whole milk, adding sugar during the process and concentrating the milk to half of its volume. The concentrate is then cooled and malai is added to it. The mixture is then filled in Plastic / Aluminium cones, capped and then frozen in ice-salt (1:1) mixture in large earthern pots. Addition of crushed nuts and flavour is optional.

Composition of Kulfi

Total solids (%)	Fat (%)	Solids-not-fat (%)
37 – 40	13 – 14	10 – 12

(Yerriswamy *et al.*, 1983)

Milk-cereal based products

Kheer

It is a similar product to that of Basundi except that good quality rice @ 2.5 to 5% is added to the milk after it has reached the first boil.

Moisture (%)	Fat (%)	Protein (%)	Lactose (%)	Ash (%)	Sucrose (%)	Other Carbohydrate (%)	Source
67.2	7.83	6.34	8.45	1.41	8.95	–	De *et al.*[1], 1976
69.0	12.2	5.9	11.3	2.3	–	–	Mani *et al.*[2], 1955
61.77	6.38	5.44	6.49	0.74	14.74	4.45	Chaudhury[3], 1989

1. From Cow milk with 4.1% fat, added 2.5% rice & 5% sugar
2. From milk with 4.1% fat, 12.5% Total solids
3. From milk with 5% fat, 9.75 SNF, added 5% rice and 12% sugar

Others

Lassi / Chhas / Matha

It is the by-product obtained during churning curdled whole milk with crude indigenous devices for the production of Makkhan. In northern India, whole milk curd beaten up to be served as a beverage, is also called 'lassi'.

Composition of Lassi

Water (%)	Fat (%)	SNF (%)	Protein (%)	Lactose (%)	Ash (%)	Acidity (% 1.a.)
96.2	0.8	3.0	1.3	1.2	0.4	0.44

(Adapted from: Table 9.5 of Indian Dairy Products by Rangappa & Achaya)

Ghee residue

It is the by-product obtained in the manufacture of Ghee. It is brown residue left in the strainer after the Ghee is filtered. It consists of denatured milk proteins, caramelised lactose, entrapped fat, minerals and water.

Composition of Ghee residue

From desi butter	Water (%)	Fat (%)	Protein (%)	Lactose (%)	Ash (%)
Cow	14.4	32.4	36.0	12.0	5.2
Buffalo	13.4	33.4	32.8	15.4	5.2
From creamery butter					
Cow	9.7	61.4	24.8	Traces	4.1
Buffalo	5.7	65.0	25.5	Traces	3.8

(Prahlad, 1954)

Conclusion

Apart from the above mentioned Indian Dairy products there are several others that are produced in different corners of our country but do not have published literature on the same. Over the millenia, the technology of processing these products largely remained unchanged being in the hands of halwais – the traditional sweet-meat makers who form the core of this cottage industry. Since the quality of milk, the manufacturing process etc. varies from region to region, the sensory and rheological characteristics, chemical composition and microbiological quality of the products also varies. Another intrinsic drawback of these products is the limited shelf-life. Attempts have been made and, therefore, industrial methods have been developed during the last decade in standardising the process, mechanising the production and packaging of some of these products like Khoa, Burfi, Gulabjamun, Ghee etc. But much remains to be done to convert the small scale manual production to large scale mechanised production so as to have a better and uniform quality products with extended shelf-life.

***Note:** This article is a brief review of various indigenous dairy products which have published literature on them. The objective of this article is to make the reader familiar with various Indian dairy products. The modern processing technology has not been covered in this article neither was it intended.*

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Mozzarella Cheese and Pizza — the Compatible Partners

by
Dr. Atanu Jana

Introduction

Cheese is appreciated by consumers for the great interest and variety it adds to the eating experience. It has an excellent image, being perceived as healthy, natural and nutritious. Cheese is an important dairy ingredient, which has the potential to add sales appeal to many food products such as processed cheese, cheese dips and spreads, bakery goods, snack foods and canned foods.

Compared to other varieties, Pasta filata cheeses (e.g. Mozzarella, Provolone and Kachkaval) are differentiated by their superior stretchability, relatively high apparent viscosity and moderate flowability and melt times. Pasta-filata cheeses are distinguished by a unique plasticizing and kneading treatment of the fresh curd in hot water, which imparts to the finished cheese its characteristic fibrous structure and melting and stretching properties. The presence of such unique functional characteristics in Mozzarella cheese enables it to dominate the fast-food market.

The volume of cheese used in cooking applications has increased significantly in recent years. As the use of these cheeses has increased, so have the demands on the functionality. When looking at pizzas, one topping you will find on almost every pizza is Mozzarella cheese. Pizza cheese is perhaps the prime example of a market driven product. There are no standards of identity for pizza cheese and so the customer dictates the standards to which it is made. The changing habits of diet and use of newer appliances for cooking and processing demands specific tailor-made functionalities.

The type of milk utilized, the ingredients used, the method of manufacture adopted and the storage conditions affects the functionality of the cheese when used as a pizza topping. In this article, the focus has been laid on certain critical points pertaining to the manufacture of cheese and its chemical composition which enables obtaining the product having desired functionality for its end use on pizza.

Production statistics

The past decade has witnessed extraordinary worldwide growth in the production of Mozzarella cheese, fuelled by a spiralling demand for pizza. There have been substantial increases in Mozzarella production in Europe and Oceania. According to the National Association of Pizza Operators and 'Pizza Today', Americans consume ~ 100 acres of pizza each day. This translates into an average of 7.7 pounds of Mozzarella cheese topping per person per year (Sanders, 1994). About 2.25 billion pounds of Mozzarella cheese is made each year in the US; ~ 75% of it is destined for a pizza. In Australia, the production figure in 1997 for shredding type Mozzarella cheese was 38,800 tones with an annual increase of > 9-10%.

Pizza as well as Mozzarella cheese are relatively new introduction to the Indian dietary system and are gaining wide popularity. In the current year, the Gujarat Co-operative Milk Marketing Federation better known by its Amul brand name is planning to open 3000 pizza outlets across 300 cities in the country. Amul expects the pizzas to boost its sale of cheese which currently stands at ~ 3500 metric tones, by another 1000 metric tones annually (Anon., 2001). The already existing mega fast-food chains are the Pizza Hut and Dominos.

Quality of Mozzarella cheese and the factors affecting it

There are two main varieties of Mozzarella cheese in existence; the soft Italian variety and the pizza variety (low-moisture, part-skim Mozzarella cheese with 30-45% Fat on dry matter (FDM) and moisture content of 45-52%). The cheese referred in this article is pertaining to the pizza variety.

Mozzarella cheese should be white in colour; have a bland, slight nutlike flavour but never sour; low melting point; should never be slimy nor coarse or rough; the rind should be very thin, soft and edible and easy to peel off from the main piece; and the cheese should be elastic.

In order to obtain such quality cheese, the adherence to certain critical points in manufacture of cheese would allow a cheese to be made having a definite composition so that it has the requisite functional properties expected from it. Some of these manufacturing parameters have been dealt with below:

Method of manufacture

There are, in general, two methods of manufacturing Mozzarella cheese. They are (i) Starter culture (SC) method and (b) Direct acidification (DA) method. The choice of the method would depend on the individual cheese maker. Variations in the cheese making parameters can affect the compositional and functional properties of Mozzarella cheese. Directly-acidified Mozzarella is functional on the day of manufacture due to its characteristically soft body caused in part by its high moisture and low calcium content (Fox, 2000). High ratio of *Streptococcus thermophilus (ST)/ Lactobacillus helveticus* (LH)(i.e. 10:1) gave highest meltability and oiling-off when fresh and during cold storage for 4 weeks compared to lower coccus : rod ratios (Hassan, 2000).

Both cow as well as buffalo milk can give good quality Mozzarella cheese. On one hand, cow milk cheese exhibits higher melting and fat leakage but has a slight yellow colour (not desirable), whereas buffalo Mozzarella is pure white in colour (hence higher appearance score) with slightly superior stringiness.

The key manufacturing parameters which are involved in determining the end-use properties of the resultant cheese are (Jana and Upadhyay, 1991a; Rowney ***et al.,*** 1999) :

Standardization of cheese milk: An easily manipulated seasonal variable is the casein-to-fat ratio, which affects the final fat content of the cheese and thus functionality, making standardization of cheese milk very important. The fat content of ~ 2-3% and 4% has been found to yield good result when making Mozzarella cheese from cow and buffalo milks respectively.
Conditions of acidification : The method of acidification - whether by starter culture or by acidulants has an effect on demineralization and curd structure and thus functionality of cheese. Even acidification by different acids may exert influence on the functional properties of resultant cheese.

Cooking temperature: The meltability and free-oil formation were not significantly affected over a narrow cooking temperature (i.e. 38-41°C); however in the range 32-46°C meltability decreased and hardness increased with increasing cooking temperature.

pH when whey is removed: Altering the pH of whey draining affects the colloidal calcium phosphate concentration and thus the casein micelle structure. This consequently affects the cheese's capacity for melting or grating. It also affects the amount of lactose retained in the cheese curd and hence influences the rate of acid development during cheddaring or dry stirring.

pH at milling: Changing milling pH in the range of 5.1-5 4 does not significantly affect the meltability and free-oil formation.

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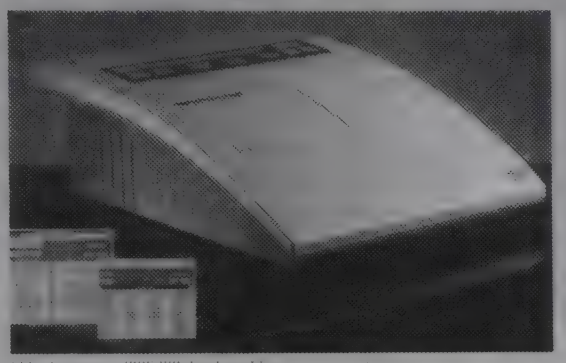

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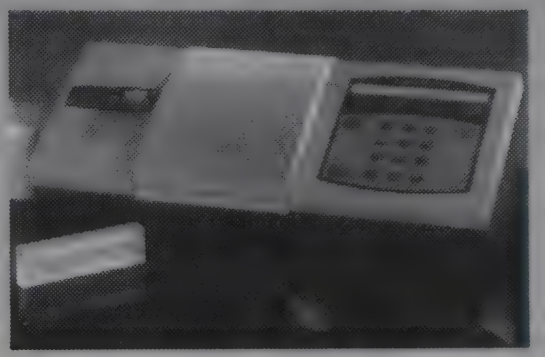

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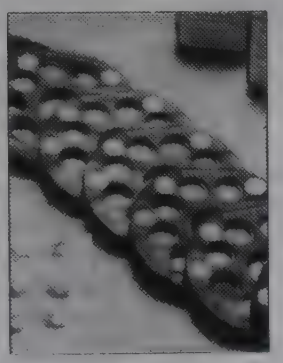

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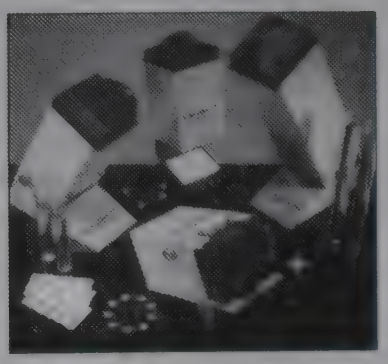

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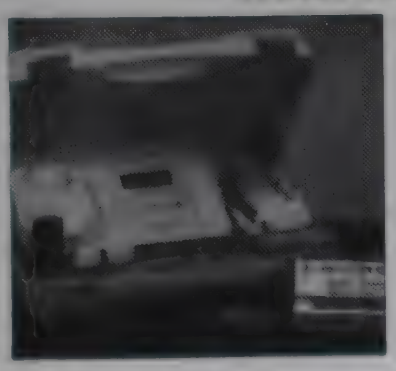

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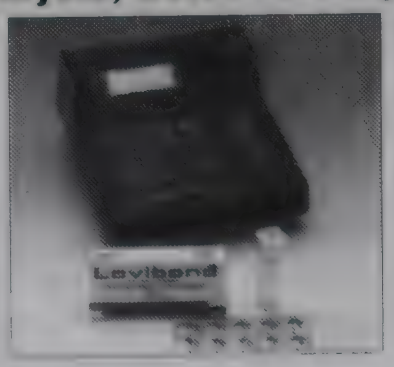

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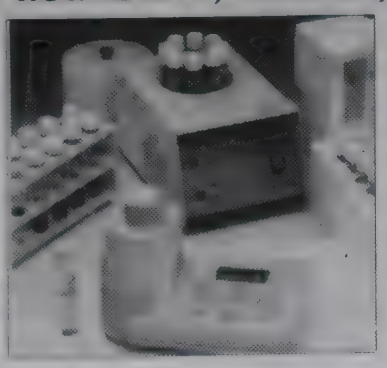

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Temperature of cheese as it exits the cooker: This parameter affects the residual activity of rennet. Use of hot water at ~ 77°C is generally used to plasticize the curd, which raises the temperature of the curd to ~ 57°C (Kosikowski, 1982). Increasing the stretching temperature in the range of 55-65°C resulted in a less springy cheese.

Method used to stretch the curd: Compared to cheese from a conventional cooker/stretcher, Mozzarella cheese produced from a high pressure, twin-screw extruder resulted in a cheese with lower meltability and no detectable free-oil.

Salting / brining : The type of salting method adopted viz., dry salting, part dry salting followed by brining, brining or stretching the curd in hot brine will have an effect on the structure of the curd formed and hence the functionality of cheese. Brining usually gives better cheese than dry salting, though the salt gradient is not uniform with the former method.

Other processing treatments

Homogenization: Homogenization of cheese milk is not a practice commonly used commercially. However, homogenization of milk at a low pressure did not affect the melting and stretching properties of cheese, at the same time gave higher cheese yield and improved flavour. Homogenization of milk or cream led to limited free oil release and melting during pizza baking of both full-fat (Jana and Upadhyay, 1991b) and reduced-fat Mozzarella cheese (Rudan ***et al.,*** 1998); in the latter case excessive browning was noticed.

Ultrafiltration: Use of ultrafiltration (UF) in cheesemaking led to difficulty in stretching of curd due to high buffer capacity and large amount of insoluble calcium salts in the cheese. Such cheeses had impaired melting behaviour due to the incorporation of whey protein into the cheese curd.

To overcome these difficulties, the following modifications were necessary (Friis, 1981) viz., (a) pre-acidification to ~ pH 6.0 with acid before UF treatment, (b) diafiltration with brine during UF with simultaneous fermentation, (c) employing dialysis-UF coupled with simultaneous fermentation, and (d) holding the cheese at 5°C for several weeks. Acceleration of proteolysis in UF-Mozzarella cheese by the addition of Neutrase / porcine trypsin enzyme improved meltability due to the increased casein degradation (Madsen and Quist, 1998).

Cholesterol-reduction: Cholesterol-reduced (64% reduction) Mozzarella made from milk treated with b-cyclodextrin and homogenized at 70 kg/cm2 and 70°C had significantly lower meltability, stretchability and oiling-off than control cheese (Kwak ***et al.,*** 2001).

Modified technique: The melting property of even a freshly made Mozzarella cheese could be improved by plasticizing the cheese curd at correct acidity at 65-70°C/10-15 min under dry condition (instead of using mould water) with 1-1.5% of mixture of trisodium citrate and disodium hydrogen phosphate (1:1) (Patel and Upadhyay, 1999). Barz and Cremer (1995) have patented a technology for manufacture of Mozzarella cheese with the addition of emulsifying salts, which provides good baking performance over a wider range of conditions compared to the equivalent natural cheese.

Chemical composition of Mozzarella cheese

The proximate composition of cow and buffalo milk Mozzarella cheese is shown in Table 1. The chemical composition of cheese determines the final characteristics of the end product. The cheese's properties result from interaction between caseins, water and fat in the curd. So the control of the following parameters would help in obtaining the desired qualities. These are:

pH of cheese : The optimum pH range lies with the type of milk, length of contact with acid and the choice of starter. The optimum pH for directly acidified cheese (i.e. 5.6-5.7) is generally higher than those made by starter culture technique (i.e. 5.2 - 5.4).

Table 1. Composition of cow and buffalo milk Mozzarella cheese

Constituents	Composition (%)	
	Cow Mozzarella	Buffalo Mozzarella
Moisture	50.30	49.81
Fat	24.80	23.05
Protein	20.31	22.35
Ash	2.76	2.96
Salt	1.72	1.56
Acidity (% LA)	0.73	0.67

Source : Ghosh and Singh (1996)

Calcium content: Reducing the calcium content of the cheese curd is probably of more importance than reaching the target pH. As calcium is removed from the curd, the caseins are better able to emulsify the fat, leading to less oiling-off upon melting of cheese.

Fat content: When determining whether to use part-skim or whole milk, Mozzarella operators should decide what they are looking for in terms of characteristics such as stretch, toughness, oiliness, flavour profile, browning and yield/coverage. In general, part-skim (made from 2% fat milk) Mozzarella cheese will offer greater stretch, chewier texture, more blistering or browning and excellent pie coverage, whereas whole milk (made from 2.6% fat milk) Mozzarella cheese will offer more flavour, less browning, softer texture and oilier appearance. As the fat is decreased, Mozzarella requires more heat to melt and rapidly loses pliability on cooling. Currently, cheese pizza is topped with a cheese containing about 20% fat. As the fat content of Mozzarella cheese increases, the softness of the cheese increases, the cheese becomes difficult to shred and meltability increases. When FDM exceeds 37%, excessive free-oil is formed during melting.

The no-fat (< 1% fat) or low-fat (6% fat) Mozzarella does not melt or fuse together well during baking. They also brown and scorch excessively, which is hardly appetizing for pizza lovers. Lack of fat diffusion results in rapid surface dehydration and skin formation during baking that limits melting, allowing scorching of cheese during baking. Applying a thin hydrophobic surface coating with an oil-spray product (an invisible glaze of a ½ g of canola oil/100 g of cheese) to the cheese before baking makes such Mozzarella behave like its full-fat counterpart (Rudan and Barbano, 1998).

Moisture content: Variation of moisture content may adversely affect the functionality of the cheese, especially meltability. Increasing the moisture content of Mozzarella cheese from 47 to 52% resulted in softer texture (poor shredability) and significantly increased meltability.

Salt content: Salting of pizza Mozzarella must be stronger than for the soft type, the optimum salt level being between 1.5 and 1.7%; higher or lower levels adversely affect the cheese's melting properties when used on pizzas (Cervantes ***et al.,*** 1983). Salt affects cheese functionality both directly through its effect on initial cheese structure and indirectly over time through its impact on enzyme activity. Within a single cheese block, regions of high salt content showed less free oil formation than regions of low-salt content.

Lactose/galactose content: The browning of cooked Mozzarella cheese is a result of the residual lactose or galactose content in the cheese.

Proteolytic activity during storage: The progressive changes in the meltability, fat leakage, and stretching properties of Mozzarella during its refrigerated storage are influenced by the proteolytic activity of the starter culture or plasmin or the enzymes elaborated by the non-starter microorganisms.

Freezing of Mozzarella cheese

Mozzarella cheese is frozen to stabilize such properties as melt, stretch, blistering, oiling-off and browning (Cervantes ***et al.,*** 1983). Shredding the cheese before freezing will allow

it to freeze more quickly, thus limiting ice crystal size. This will yield a cheese structure that retains its maximum cohesiveness upon thawing. A drop in temperature between -1°C and -7°C is critical to textural changes. Freezing increased hardness and stretchability, decreased meltability and caused less free-oil formation. Shredding of the cheese before freezing was also found to increase stretchability and decrease meltability.

A disadvantage of freezing is that acid flavour defect, low cohesiveness, and poor melting properties initially characterize the thawed cheese. Rapid freezing minimizes these defects and the requisite thawing time (Cervantes ***et al.,*** 1983).

Aging of Mozzarella cheese

Newly manufactured Mozzarella is unacceptable as a pizza ingredient because it melts to tough, very elastic and somewhat granular consistency with poor water holding capacity and limited stretch. However, with too much aging it makes the cheese too soft for shredding and fluid when melted and is no longer acceptable for pizza.

Mozzarella needs approximately 10 days to develop its flavour profile. From the 10th day of its 30-45 day life at 5°C, Mozzarella should have its optimum flavour profile, meltability and workability. During 1-2 weeks of refrigerated storage, the cheese texture mellows to a more moderately elastic state. It then has optimum functionality for use on pizza, as it is softer, more homogeneous and has better melted consistency (Kindstedt ***et al.,*** 1992).

Cheese moisture content and proteolytic breakdown of casein have been implicated as factors associated with functional changes during aging (Kindstedt ***et al.,*** 1988; Tuckey, 1974). The development of adequate water-binding ability during ageing appears to be an important prerequisite to the attainment of desirable baking characteristics. Pizza cheese with poor water-binding ability is more likely to experience excessive dehydration and the onset of scorching or severe blistering during baking than the one with high water-binding capacity.

Performance of Mozzarella cheese destined as a pizza topping

In general, the cheese should be sufficiently firm to allow shredding and when cooked, it should exhibit good meltability, stretchability and elasticity. Free-oil formation and browning/blistering are also important. The Mozzarella cheese manufacturers consider shredability, meltability, stretchability, elasticity and stringiness to be equally important for consumer satisfaction. For a pizza retailer, the most important attributes were flavour, meltability and shredability.

Consideration needs to be given to the time and temperature of cooking, as well as the type of oven used (e.g. convection or forced-draft impingement) and the temperature at which the consumer will eat the cheese. The physical and chemical nature of the pizza base and the sauce should also be considered, as melting is affected by the diffusion of ions/compounds between the tomato sauce and the cheese (Wang et al., 1998).

On baking in a conveyor pizza oven with high velocity air flow at high temperature, an aged (1-3 weeks at 4°C) cheese develops a moist, glistening appearance with discrete dark patches (i.e. blisters) scattered over the surface of the melt and with no evidence of shred outlines. The mouthfeel of the melted cheese is smooth and moderately chewy. Peak functionality varies depending on the expectations of the specific user and is defined by characteristics such as size, distribution and colour of blisters, extent of oil release, uniformity of the melt, and degree of stretch and chewiness (Kindstedt and Guo, 1997).

Some of the relevant baking characteristics of pizza cheese are discussed herein.

Shredding properties: Mozzarella cheese must be firm enough to shred. Excessively soft and gummy cheese shreds poorly and clogs up mechanical shredders. When used for pizza and most other applications, the cheese must first be cut, diced or shredded into discrete particles of uniform size in order to facilitate even distribution and melting on the pizza (Lorton, 1987). Hence, the shredded particles should resist clumping. Mozzarella cheese makers recognize poor shreddability as a serious problem. By direct acidification at set pH values < 5.58, the cheese was unsuitable for shredding as it was over sticky.

For good firmness, there needs to be strong protein-to-protein interaction, so that a strong protein matrix is formed. Shreddability generally decreases with increasing cheese moisture content. High moisture Mozzarella varieties typically do not shred well, while low-moisture and low-moisture part-skim Mozzarella display superior shredding properties. If the FDM is > 38%, then the cheese is softer and has poor shredding properties. Acid production by starter affect moisture content and hence the shredding properties. Storage of Mozzarella cheese up to 2 weeks makes the cheese too soft for shredding (Mc Mahon et al., 1993).

Stretchability: Stretchability is the ability of the melted cheese to form fibrous strands that elongate without breaking under tension. This term is sometimes used interchangeably with stringiness. These strands should have the ability to resist permanent elongation i.e. elasticity or 'strength of the stretch'. The cheese must exhibit stretchability and elasticity, but should not be tough and overly chewy.

The stretching properties of Mozzarella cheese are related to curd pH and the proportion of colloidal calcium phosphate retained in the curd; optimum pH for stretching of Mozzarella cheese produced by the SC method was ~ 5.2, whilst that of cheese produced by DA (since increased demineralization occurs in DA method) was 5.7-5.8 in conjunction with calcium levels of 525 and 512-520 mg calcium / 100 g cheese respectively (Lawrence ***et al.,*** 1987; Valle ***et al.,*** 1996). The calcium/phosphate level is dependent on the activity of the culture i.e pH at which the whey is drained from the curd. Very high calcium content in cheese (>0.5%) gives a short stretch and a

tough and grainy texture. Mozzarella cheese's stretching properties may be related to having a high content of intact casein (aS1-casein) and large peptides. The proteolytic activity of the culture influences the stretchability of cheese (Sigsgaard, 1994). High fat Mozzarella cheese is less stringy. A high salt content favoured a less stringy cheese, initially after manufacture. The stretching properties slowly decrease with age as the aS1-casein is slowly degraded by the native milk proteinases present.

Industrial assessment is typically done by inserting a fork into the cheese on a cooked pizza and seeing how far the cheese stretches (minimum 7.5 cm from the surface of pizza), unbroken from the fork to the surface of the pizza (USDA, 1980).

Meltability: When Mozzarella cheese is cooked, it should form a continuous melt with no individual cheese particles evident. Meltability refers to the capacity of cheese particles to coalesce to a uniform continuous layer of melted cheese. The cheese must melt readily but not excessively so as to become 'soupy'.

Melting quality of Mozzarella cheese depends upon several factors e.g. fat, moisture, pH/acidity, salt and certain other chemical properties. A significant positive correlation between moisture content and meltability of directly acidified Mozzarella cheese was reported. Meltability is also positively correlated with calcium and phosphate in dry matter, viscosity and modulus of elasticity (Keller ***et al.,*** 1974); a low calcium content (~0.3% as in direct acid cheese) gives better melting cheese (Anon., 1999). Meltability of cheese was affected significantly by the type of acid (citric acid gives more melt than phosphoric acid) and the pH of coagulation. High fat Mozzarella melts more than a low-fat one. A high salt content favoured a less meltable cheese, initially after manufacture (Sigsgaard, 1994). Use of Endothia parasitica milk-clotting enzyme enhanced the meltability by greater hydrolysis of b-casein. Chymosin gave better melting cheese than using Mucor miehei, bovine pepsin or porcine pepsin (Mc Mahon ***et al.,*** 1993). Use of SC method gives better melting ability than when using DA method. Pasteurized milk cheese had greater meltability than raw milk cheese (Patel, 1984). The melting property of grated/diced Mozzarella cheese has been found to improve on application of an anti-caking agent (Berry, 1999).

Homogenization of milk and concentration of milk gave decreased meltability (Jana and Upadhyay, 1991b; Sharma, 1991). For good meltability, there needs to be strong protein-to-water interactions. The progressive changes in melting properties of Mozzarella during its refrigerated storage are influenced by the proteolytic activity of the starter cultures.

Oiling-off: Free-oil formation is the tendency of free oil to separate from the melted cheese body and form oil pockets, particularly at the cheese surface. The property is also called 'oiling-off' or 'fat leakage'. The cheese should not release pools of oil onto the cheese surface. However, a moist appearance due to slight oil release is sometimes desired. The fat in Mozzarella cheese exists as globules dispersed in the serum throughout the protein matrix, and during melting it coalesces into pools that flow as the protein matrix collapses.

Oiling off is determined by the (a) fat content and (b) by the structure of the protein matrix. High fat content often results in high oiling-off. Low pH and high salt content reduces the level of calcium, which gives an emulsified fat phase that causes less oiling-off (Kindstedt, 1992; Sigsgaard, 1994). The tendency of free-oil separation when cheese melts, is associated with the melting property of cheese. An excessive proteolytic activity will give an open protein structure and result in relatively much oiling-off

The amount of free oil formed increases during the first 2 weeks of storage. According to Rudan ***et al.,*** (1999) the minimum amount of free oil release necessary to obtain proper functionality during pizza baking was between 0.22 and 2.52 g of fat / 100g of cheese, whereas as per Breene ***et al.*** (1964) cow milk Mozzarella cheese should have at least 2.5cm^2 of fat leakage for baking purpose.

Fat leakage can be reduced by decreasing the fat content of cheese milk or by low pressure (25-50 kg/cm^2) homogenization of the standardized milk (Patel, 1984; Jana and Upadhyay 1991b).

Browning: Browning / blistering occurs at the cheese surface during high temperature baking. It is characterized by the formation of a skin-like layer containing coloured patches that may range from light or golden brown to black. The cheese should not take on a burnt appearance, although acceptable intensity of browning can vary greatly depending on market expectations (Lorton, 1987).

Browning and burning on the pizza is age-dependant. A high degree of browning occurs when the cheese is fresh, but browning decreases dramatically during the first two weeks of ageing, followed thereafter by a sharp increase. The browning of cooked Mozzarella cheese is a result of residual lactose or galactose in the cheese undergoing Maillard browning reactions with peptides and amino acids (Johnson and Olson, 1985). If the caseins are not hydrolyzed, as occurs when Mozzarella is made by DA rather than adding starter cultures, the cheese remains white upon cooking and does not brown even though there is considerable lactose present (Oberg ***et al.,*** 1991; Jana, 1992). Most strains of *S. thermophilus* (ST) utilize only the glucose component of lactose, releasing free galactose that accumulates in the medium. A high salt content (> 4% salt in water) inhibits activity of culture, leaving large amount of unfermented galactose in the cheese leading to increased browning. There are some strains of L. helveticus (LH) that readily ferments galactose; these are increasingly being looked at for use in making Mozzarella cheese that has minimal browning upon cooking. ST and LH in 1:10 ratio gave reduced degree of browning in Mozzarella cheese, whereas use of ST and *Lactobacillus bulgaricus* (LB) in 1:1 proportion gave the maximum browning (Hassan, 2000). Use of combination of gal + LB with gal + ST is effective in reducing residual galactose levels.

Blistering : The number and size of blisters is closely related to the proteolytic activity of the culture and therefore also to the age of the cheese. A young cheese will have many small blisters. Aged cheese will have a few and large blisters (Sigsgaard, 1994).

Once the basic approach to the end-user property of cheese is mastered, one can get an idea about what manufacturing aspects to be adopted so as to arrive at a pizza cheese of defined chemical composition having the requisite functional properties as dictated by the customer. This will ensure goodwill between the retailer and the customer and promote cheese sales.

Conclusion

During the last 3 decades, the pizza restaurant trade has experienced expansive growth and the industry has become increasingly specialized. As a consequence, the demand for cheese with functional properties tailored for specific applications is growing. As a result of the changes that occur in the functional characteristics of Mozzarella cheese during ageing, and the direct effects that can be attributed to elements of the manufacturing stage, it is a challenge for manufacturers to produce a consistent product with the required functional characteristics. To meet this demand in the future, cheese makers will need a better understanding of the basic chemical, biological and processing parameters that govern the functional characteristics of this cheese. The adoption of advanced technology will entail modification in the existing procedures of pizza cheese manufacture so as to avail of the benefits of the newer technology at the same time yield a cheese which is compatible with its partner - the pizza.

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Rheological Characterization of Sandesh: An Instrumental Study

by
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S.C. Paul, P. Maity, S.K. Sarkar and S.P. Sarkar

Abstract
Samples of sandesh namely karapak and narampak were procured from Kolkata and its adjoining areas. The samples were analysed for chemical composition, rheological characteristics and microbial quality. The chemical and rheological properties varied widely between karapak and narampak sandesh. Karapak sandesh showed low moisture and fat content and high protein, sugar, ash and additive content compared to narampak sandesh. The texture profile study showed karapak sandesh had higher hardness, fracturability, adhesiveness, cohesiveness, gumminess and resilience and lower value of springiness compared to narampak sandesh. The value of chewiness of karapak sandesh was found to be very close to that of narampak sandesh. The comparison of microbial quality of karapak and narampak sandesh showed low standard plate count, coliform count, yeast and mold count and staphylococci count for karapak sandesh compared to those of narampak sandesh.

Introduction
Sandesh is one of the oldest chhana based sweets mostly popular in eastern India. Sandesh is an important source of protein, fat, sucrose and fat soluble vitamins like A,D,E,K. Sandesh can be classified into three major groups such as soft grade (narampak), hard grade (Karapak) and Kanchagolla. Cow milk is preferably used for sandesh making for its soft body, smooth texture and small grains (Sen and Rajoria, 1985). Soft grade sandesh having soft body, smooth texture with small size grains showed lower sugar content and higher moisture content than hard grade sandesh. The hard grade sandesh having firm body and coarse texture, big grain size contain higher proportion of sugar but lower amount of moisture than soft grade sandesh.

Srinivasan and Anantakrishna (1964) described the method of sandesh preparation suitable for small scale operation. Sarkar (1975) determined the chemical composition of two common varieties of sandesh sold in Kalkata market. Hard grade sandesh was found to contain less moisture, fat and protein but higher amount of sucrose than soft grade sandesh. Singh and Ray in 1977 reported some minor differences in the chemical composition of sandesh prepared by using three different coagulants such as citric acid, lactic acid and sour whey and compared the results with those of market samples. The microbiological quality of hard grade sandesh was found to be better than soft grade sandesh and kanchagolla (Sen and Rajoria 1989). The same authors in 1990 standardized the methodology of production of soft grade sandesh. The effect of processing conditions, like use of different coagulants, kind of milk and use of nolen gur on the textural properties of sandesh was reported by Sen and Rajoria (1991). A comparison of microbial count of laboratory made kanchagolla prepared from cow milk and that of market samples of kanchagolla revealed higher count of the latter than the former (Sen 1992). Devenagar ***et al.***, (1994) substituted cow milk with goat milk for preparation of channa and observed that goat milk could be used to replace up to 50% cow milk without affecting the organoleptic quality of sandesh. Mondal ***et al.*** in 1996 reported that chhana made from 1 1 blend of soya milk and buffalo milk could be used to prepare acceptable quality of sandesh. Sen and Rajoria (1996) prepared narampak buffalo milk sandesh with smoother, softer an glossier body by replacing 50% cane sugar with corn syrup Sandesh samples treated with 0.10% cardamom, a nature preservative, was found to have acceptable shelf life of 24 day at 30°C and 85 days at 7°C (Sen and Rajoria 1996). The use o 0.01% sorbic acid was found to extend the shelf life up to si days at 30°C and 56 days at 7°C temperature of storage.

However a systematic study of rheological properties o karapak and narampak sandesh has not yet been reported. The present work has been undertaken to characterize by instru mental means the rheological properties of karapak and narampak sandesh collected from Kolkata and its suburb.

Materials and Methods
The samples of karapak and narampak sandesh were collected from Kolkata and its adjoining areas (350 samples each o karapak and narampak sandesh). The samples were collected in a rigid ice container taking all care to avoid compaction or any structural deformation during transit.

Samples of sandesh were analysed for their chemical com position (moisture, protein, fat, sugar, ash and additive con tent). Moisture and ash content were measured following the method as described in IS: 4079, protein was estimated by Kjeldahl's methods (IS: 4079), fat was estimated by Gravemetri method (Rose – Gotlieb method) and sugar was estimated by Lane – Eynone method as described in IS: 4079. Additive was determined by the method of difference.

A Texture Analyser model number TAHDi (Stable Micro System, U.K.) fitted with a 25 kg load cell was used for two bites linear compression of sandesh (karapak and narampak). A cross head pre test speed 2.0 mm/s, test speed 5.0 mm/s, pos test speed 5.0 mm/s and 5 seconds interval between two successive bites were employed for 50% compression of sam ples. A cylindrical probe of 75 mm diameter (P- 75) was used for textural study. The Texture Analyser having separate soft ware (Texture Expert) for its operation was run under Windows environments (Windows 98). A microprocessor (IBM, Pentium II) has been coupled with Texture Analyser to run the Texture Expert program. In the Texture Expert, result file has been programmed to calculate Texture Profile Analysis (TPA) data from the measurements. The hardness, fracturability and adhe siveness were directly calculated from Force – Time curve

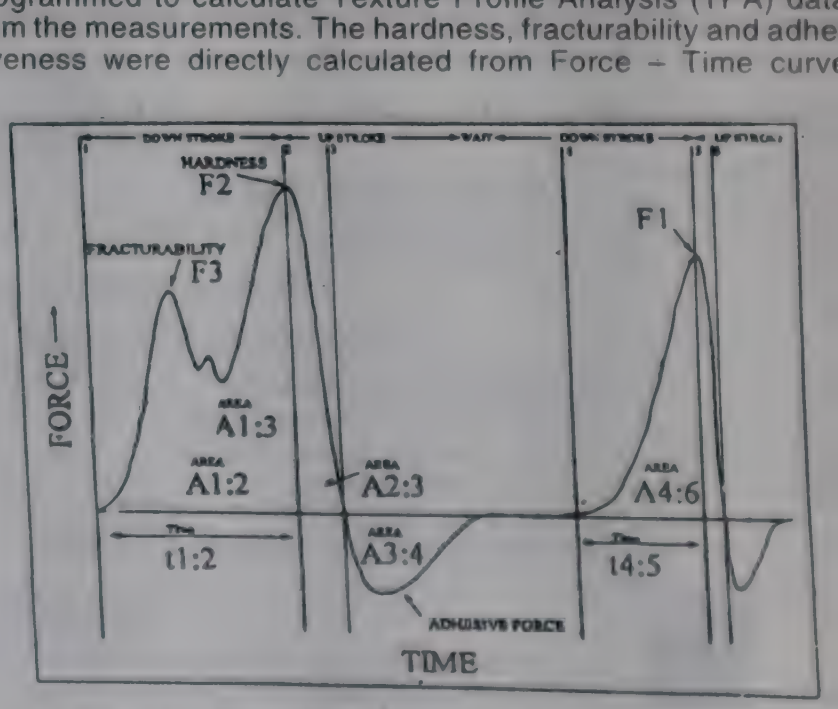

Fig 1. Two – bite Force – Time Compression Curve

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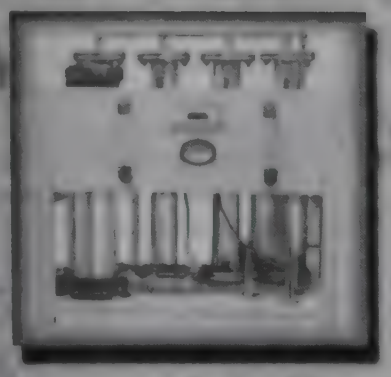

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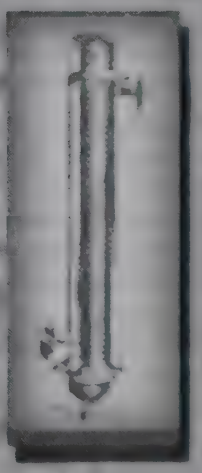

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(Fig. 1). Other parameters were obtained as follows:

Springiness ..... L 4:5/L 1:2
Cohesiveness ..... A 4:6 / A 1:3
Gumminess ..... F 2 × Cohesiveness
Chewiness ..... Gumminess × Springiness
Resilience ..... A 2:3 / A 1:2

The statistical analysis of texture profile data of sandesh samples were done with the help of Windows Microsoft Excel 2000 using Two Factor ANOVA method.

The microbiological examinations of sandesh samples were also carried out to determine the standard plate count, total coliform count and yeast and mold count following APHA (1978). Staphylococci were enumerated by the method of APHA (1978) on S – 110 staphylococcus agar medium (Chapman 1946).

Results and Discussion

The samples of karapak and narampak sandesh were analysed for moisture, protein, fat, sugar, ash and additive content.

Table 1: Average Chemical Composition of Sandesh

Type of sample	Moisture (%)	Total solid (%)	Protein (%)	Fat (%)	Sugar (%)	Ash (%)	Additives (%)
Karapak	14.15	85.85	19.53	16.95	43.08	1.66	2.40
	(12.27 - 15.23)		(16.22 - 19.83)	(16.26 - 8.11)	(42.31 - 47.68)	(1.62 - 2.12)	(0.00 - 4.02)
Narampak	23.26	76.64	18.00	17.47	38.08	1.45	1.74
	(21.23 - 24.15)		(16.21 - 18.62)	(16.24 - 17.77)	(37.29 - 38.99)	(1.22 - 1.81)	(0.00 - 7.74)
S.D. (±)	4.55		0.765	0.260	2.50	0.105	0.33
P - Value	0.0116		0.3412	0.7456	0.1144	0.1112	0.2611

Figures in the parenthesis indicate range.
Number of samples analysed: 350 samples each of karapak and narampak sandesh

The average composition of karapak sandesh was found to be: moisture 14.15% (12.27 – 15.23%), protein 19.53% (16.22 – 19.83%), fat 16.95% (16.26 – 18.11%), sugar 43.08% (42.31 – 47.68%), ash 1.64% (1.62 – 1.66%) and additive 2.40% (0.00 – 4.02%) and those of narampak sandesh were: moisture 23.23% (21.23 – 24.15%), protein 18.00% (16.21 – 18.62%), fat 17.47% (16.24 – 17.77%), sugar 38.08% (37.25 – 38.99%), ash 1.45% (1.22 – 1.81%) and additive 1.74% (0.00 – 4.74%). Significant differences in chemical composition of karapak and narampak sandesh were observed. The investigation revealed high protein, sugar, ash and additive content and low moisture and fat content for karapak sandesh compared to those of narampak sandesh. The results of chemical composition (except fat content) of karapak sandesh are in agreement with the findings of Sen ***et al*** (1989) for hard grade (karapak) sandesh, however the fat content of karapak sandesh was slightly higher than that reported by Sen ***et al*** (1989). In case of narampak sandesh the present findings of moisture, protein, fat and sugar content are close to the reported values of Sen ***et al*** (1989), but the ash content was found to be slightly higher than that reported by Sen ***et al*** (1989). The variation in moisture and sucrose contents in soft and hard grade sandesh of Kolkata market were also observed by Sarkar (1975). He has observed lower moisture and higher sugar content for karapak sandesh and higher sugar content of narampak sandesh compared to those of present findings.

Table 2: Texture Profile Parameters of Karapak and Narampak Sandesh

Type of rasogolla	Hardness (g	Fracturability (g)	Adhesiveness (gs)	Springiness (mm)	Cohesiveness	Gumminess (g)	Chewiness (g mm)	Resilience
Karapak	11.033	9.676	-0.280	0.431	0.302	3.337	1.438	0.190
	(10.915 – 11.165	(9.568 – 9.812)	(- 0.321 to – 0.210)	(0.415 – 0.447)	(0.297 – 0.312)	(3.129 – 3.412)	(1.365 – 1.512)	(0.161 – 0.212)
Narampak	10.223	8.845	- 0.939	1.202	0.199	1.217	1.462	0.070
	(10.117 – 10.301)	(8.641 – 9.901)	(- 0.921 to – 0.942)	(1.191 – 1.212)	(0.122 – 0.223)	(1.211 – 1.223)	(1.454 – 1.471)	(0.068 – 0.081)
S.D. (±)	0.4050	0.4155	0.3295	0.3855	0.0515	1.060	0.012	0.060
P - Value	0.3304	0.0433*	0.3186	0.0555	0.3472	0.2772	0.5051	0.1429

Figures in the parenthesis indicate range.
Number of samples analysed: 350 samples each of karapak and narampak sandesh
* Differences are significant

The average texture profile parameters of karapak sandes collected from Kolkata and its adjoining areas were found to b hardness 11.033g (10.915 – 11.165 g), fracturability 9.676 (9.568 – 9.812), adhesiveness – 0.280 gs (– 0.321 to – 0.21 gs), springiness 0.431 mm (0.415 – 0.447), cohesiveness 0.30 (0.297 – 0.312), gumminess 3.337 g (3.129 – 3.412 g), chew ness 1.438 g mm (1.365 – 1.512 g mm) and resilence 0.19 (0.161 – 0.212). The texture profile parameters of narampa sandesh were: hardness 10.233 g (10.177 – 10.301 g fracturability 8.845 g (8.641 – 9.901), adhesiveness – 0.939 g (– 0.921 to – 0.942 gs), springiness 1.202 mm (1.191 – 1.21 mm), cohesiveness 0.199 (0.122 – 0.233), gumminess 1.217 (1.211 – 1.223 g), chewiness 1.462 g mm (1.454 – 1.471 g mm and resilience 0.070 (0.068 – 0.81).

The comparison of texture profile analysis of karapak an narampak sandesh revealed higher value of hardness fracturability, adhesiveness, cohesiveness, gumminess an resilience and lower springiness and chewiness for karapa sandesh compared to those of narampak sandesh. A significan difference in fracturability c karapak and narampa sandesh ($P < 0.05$) was als observed. Sen ***et al*** in 198 reported the hardness c market samples of karapa and narampak sandes were 22.2 ± 1.5 and 130 6.6 respectively expresse as multiple of 0.1 mm/fiv seconds using Toshniwal penetrometer.

Table 3: Microbial Quality of Karapak and Narampak Sandesh

Type of sample	Standard plate count (cfu/g)	Coliform count (cfu/g)	Yeast and mold count (cfu/g)	Staphylococcus count (cfu/g)
Karapak	18.00×10^2 (6.4×10^2 – 2.96×10^3	36 (24 – 49)	21 (10 – 24)	2.5×10^3 (1.1×10^3 – 3.2×10^3)
Narampak	22.60×10^5 (22.56×10^5 – 22.63×10^5)	130 (125 – 147)	87 (63 – 127)	11.5×10^5 (6.5×10^5 – 14.5×10^5)

Figures in the parenthesis indicate range.
Number of samples analysed: 350 samples each of karapak and narampak sandesh

The microbial quality of karapak and narampak sandesh collected from Kolkata market was also judged by determining the standard plate count, coliform count, yeast and mold count and staphylococcus of the samples. The samples of karapak sandesh showed standard plate count 18.00×10^2 cfu/g ($6.4 \times 102 – 2.96 \times 10^3$ cfu/g), coliform count 36 cfu/g (24 – 49 cfu/g) yeast and mold count 21 cfu/g (10 – 24 cfu/g) and staphylococcus count 2.5×10^3 cfu/g ($1.1 \times 10^3 – 3.2 \times 10^3$ cfu/g). The values of yeast and mold count were in agreement with reported value of market samples of karapak sandesh ($2.8 \times 10^1 \pm 7.1 \times 10^0$ cfu/g) by Sen and Rajoria (1989), but the value of standard plate count was lower and coliform count and staphylococci count were higher than the reported results.

The samples of narampak sandesh showed standard plate count 22.60 × 105 cfu/g ($22.56 \times 10^5 – 22.63 \times 10^5$ cfu/g), coliform count 130 cfu/g (125 – 147 cfu/g), yeast and mold count 87 cfu/g (63 – 127 cfu/g) and staphylococcus count 11.5×10^5 cfu/g ($6.5 \times 10^5 – 14.5 \times 10^5$ cfu/g). The values of yeast and mold count of narampak sandesh were in agreement with that of soft grade sandesh ($15.0 \times 10^1 \pm 4.1 \times 10^1$ cfu/g) reported by Sen and Rajoria (1989) whereas the value of standard plate count, coliform count and staphylococci count

were found to be lower than those reported by the same authors.

Low standard plate count, coliform count, yeast and mold count and staphylococcus count of karapak sandesh compared to narampak sandesh were probably due to low moisture content of karapak sandesh than that of narampak sandesh and high heat treatment given during manufacturing of karapak sandesh.

Conclusion

The present investigation revealed that karapak sandesh had low moisture and fat content and high protein, sugar, ash and additive content compared to narampak sandesh. The instrumental measurement of texture profile study showed karapak sandesh had higher hardness, fracturability, adhesiveness, cohesiveness, gumminess and resilience and lower springiness compared to narampak sandesh, Chewiness value was found to be comparable between karapak and narampak sandesh. The standard plate count, coli form count, yeast and mold count and staphylococcus count were found to be lower for karapak sandesh compared to narampak sandesh.

Acknowledgements

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The World Market for Dairy Products

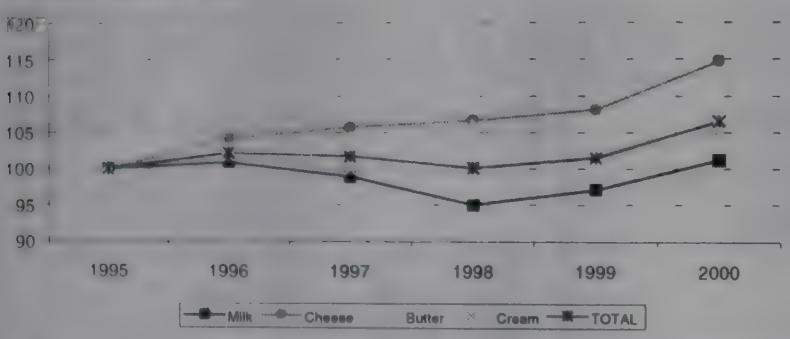
Information extracted from a report "The World Market for Dairy Products, 2001" published by Euromonitor International

Market Structure
Global Trends and Market Breakdown

- The global market for dairy products as defined in this report is believed to have recovered somewhat in 2000 (to US$211.3 billion), due in part to improved economic conditions in parts of Latin America and South East Asia, as well as a return to value growth in Western Europe.
- The market is nevertheless mature, growing by just 6.5% between 1995 and 2000. Growth has been held back by changing dietary habits which do not favour high-fat foods, and by depressed prices due to competitive pressure - particularly from private label products.
- Growth has also been negatively impacted by a stagnation in the volume consumption of milk, the largest sector, which has largely become a commodity market.
- Cheese was the most dynamic market sector over the 1995-2000 period, increasing value sales by almost 15%. This was largely due to the popularity of cheese-based dishes in developed and certain emerging markets, such as Mexican foods and pizzas.
- Butter and cream sales rose gradually over the 1995-2000 period, benefiting from a recent return to traditional tastes and a backlash against "better-for-you" products in certain markets, such as the US.

Trends in Dairy Product Sales by Sector 1995-2000

Index 1994 = 100



- A breakdown of the four broad sectors covered in this report reveals that milk is by far the largest sector, accounting for just over half of total sales in 2000, with a market value of almost US$107.5 billion.
- Cheese makes up a large proportion of the remaining value sales, estimated at US$80.1 billion in 2000, whilst butter and cream are relatively small sectors, worth some US$15.5 billion and US$8.2 billion respectively in that year.

The above information is extracted from a report "The World Market for Dairy Products, 2001" edition published by Euromonitor International. • Tel: +65 429 0590 • Fax: +65 324 1855 • e-mail: angel@euromonitor.com.sg • 40 Tras St Singapore 078979 • Iniernet: http://www.euromonitor.com

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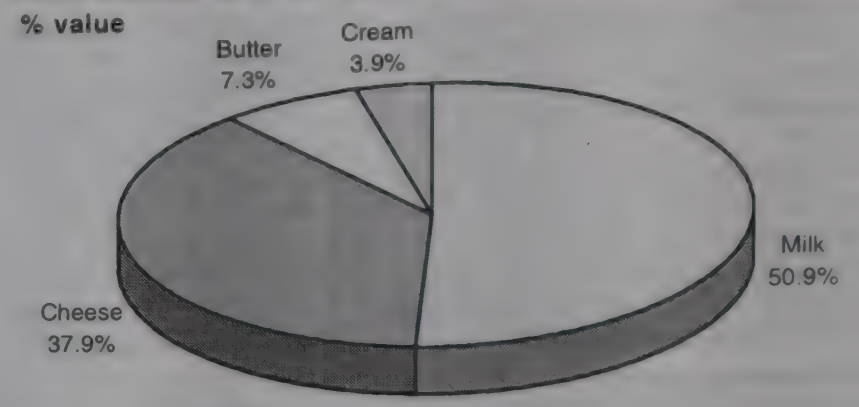
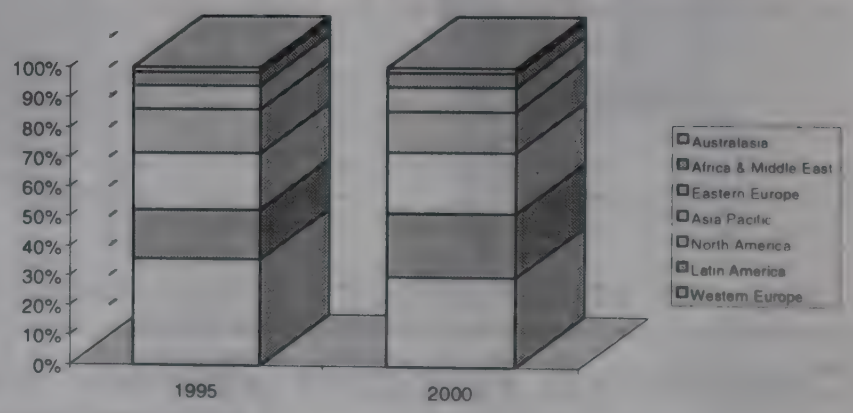
Value Breakdown of the Global Dairy Products Market 1998-2000



Regional Trends

- Western Europe is the biggest region in terms of overall dairy products' sales by value, accounting for 30.1% of the global market in 2000. Latin America and North America represent a further 21.4% and 20.3% of global sales respectively.
- In Asia-Pacific, dairy products are a relatively new phenomenon, and are not generally considered essential to national diets. As such, sales in this region accounted for just 13.9% of the global market by value in 2000.
- Australasia is by far the smallest region under review in terms of dairy products' sales, which is due to its low population size rather than lesser importance of dairy products in national consumption.
- Over the review period, double-digit value growth increases were achieved in the emerging regions of Latin America, Africa and the Middle East, as well as the more mature regional markets of North America and Australasia.
- Dollar value sales in Western Europe declined as a result of price pressure and market maturity. The situation was exacerbated by the weakness of the Euroeuro.

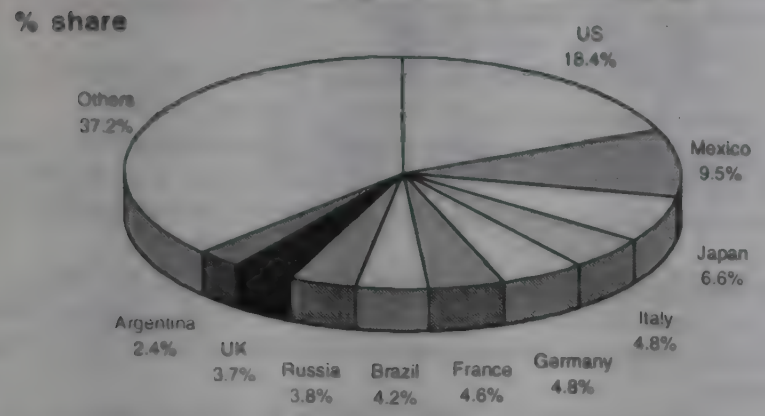
Dairy Products Value Sales by Region 1995/2000



National Trends

- There are only 10 markets worldwide that are estimated to have generated dairy sales of more than US$5 billion in 2000 and most of the world's largest dairy markets are situated in North America, Latin America and Western Europe.
- The US far outweighs any other major market in terms of value sales, accounting for 18.4% of global sales in 2000.
- At just over half this size, Mexico is the world's second largest dairy products market, due to the importance of dairy products such as cheese in the Mexican diet.
- Only three other markets notched up value sales of more than US$10.0 billion in 2000, namely Japan, Italy and Germany. However, per capita consumption is very low in Japan by Western standards, as dairy products do not form a traditional part of the national diet.

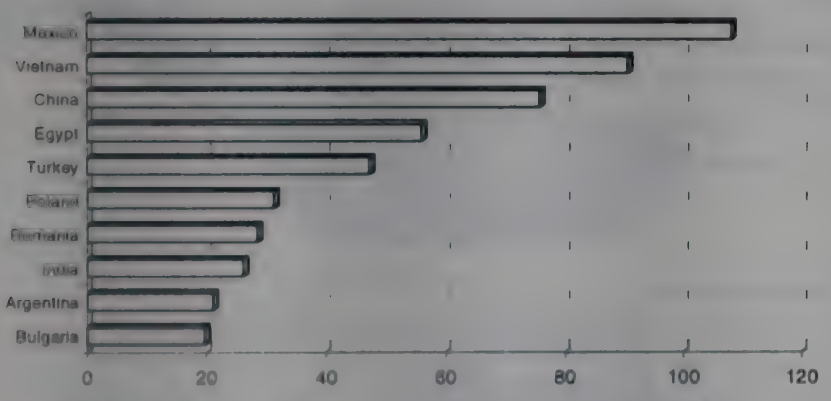
World's Ten Largest Dairy Markets 2000



- In terms of percentage growth, maximum growth was achieved over the 1995-2000 period in developing markets such as Mexico, Vietnam, China, Egypt and Turkey. However, some of these markets remain very small, which translated into relatively low additional sales.
- Mexico's value growth is a false impression, due to the country's hyper inflation. However, strong growth in Vietnam, Turkey and China was the result of strong governmental support for the dairy industry, combined with increased disposable incomes.
- Whilst the US market grew by less than 15% in percentage terms over the 1995-2000 period, this is a particularly attractive market in terms of growth in absolute sales, having increased by a value of more than US$5 billion over the review period.

Highest % Growth Markets for Dairy Products 1995/2000

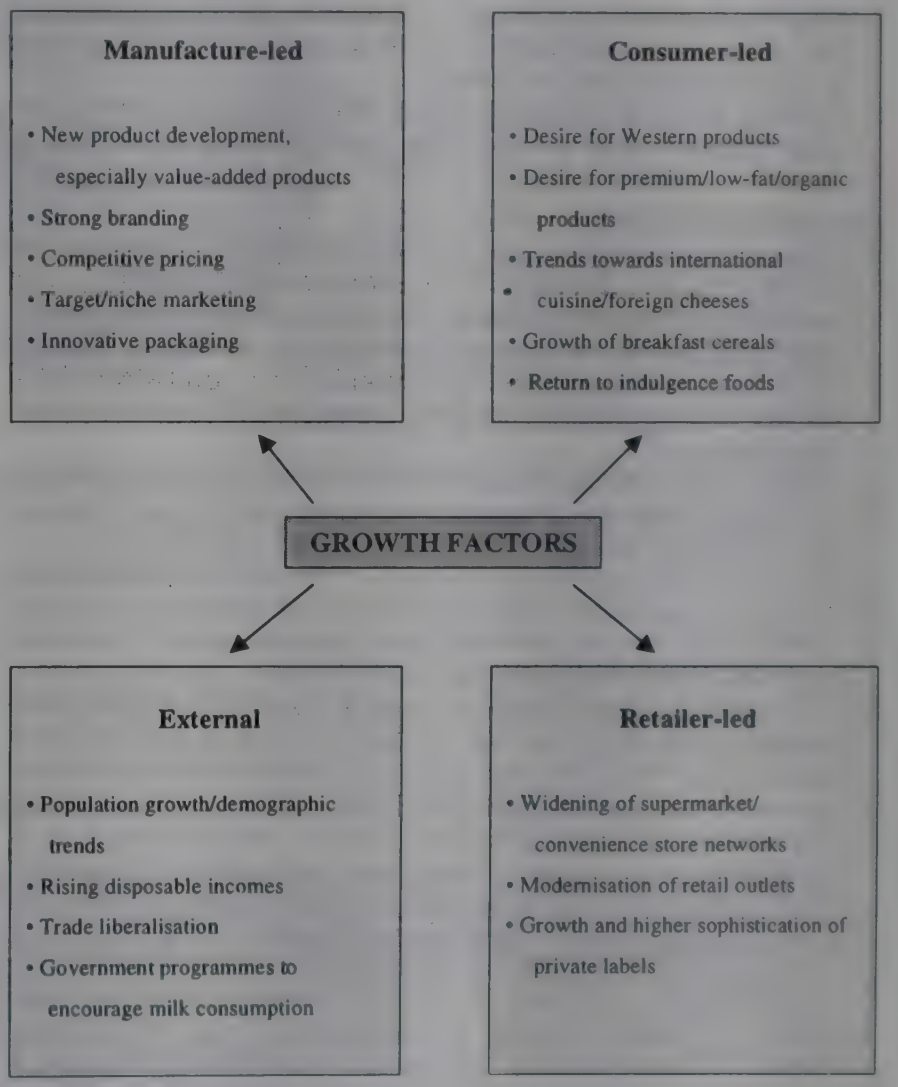
% growth 1995/2000



National Per Capita Trends

- Per capita consumption of milk is particularly high in Northern Europe, with Finnish consumers purchasing 178 litres of milk and spending US$194 in 1999. The average cost of milk is relatively high in the Nordic countries, reflecting the relative wealth and high cost of living.
- Consumers in Northern Europe and Eastern Europe are most likely to buy cream and butter, as these nations tend to cook with cream or butter as opposed to olive oil.
- Belgium has the highest levels of per capita consumption and expenditure on butter, reflecting the high usage of butter in cooking in this country.
- Russians traditionally consume large quantities of butter, as there is as yet virtually no consumer culture for such substitutes such as margarines.
- Most high-consuming cheese nations are based in Western Europe, where cheese traditionally forms an important part of the meal structure, as well as being consumed as a snack with bread or toast.
- Mexicans are also high consumers of cheese, this being an important component of Mexican cuisine.

Sources of Growth for Dairy Products 2000



Sources of Growth

Overview

- Growth in the dairy products market was underpinned largely by the continued launch of new products by the major players, which has been due to growing popularity of Western-style products, as well as generally improving economic conditions and purchasing power.
- In mature markets particularly dairy products such as foreign cheeses and cream have benefited from trends towards international cuisine (such as Mexican and Italian dishes), as well as the popularity of flavoured coffees.
- In certain markets (notably the US), a return by some consumers to indulgence foods has also led to renewed growth in butter and cream.
- Manufacturers have been able to enter emerging markets or form joint ventures as a result of trade liberalisation in many countries.
- Improved distribution of dairy products in emerging markets has resulted from the growth of supermarket chains with proper refrigeration facilities.
- In mature markets, private labels have become increasingly sophisticated and competitive, and pushed dairy prices down.

Product Development

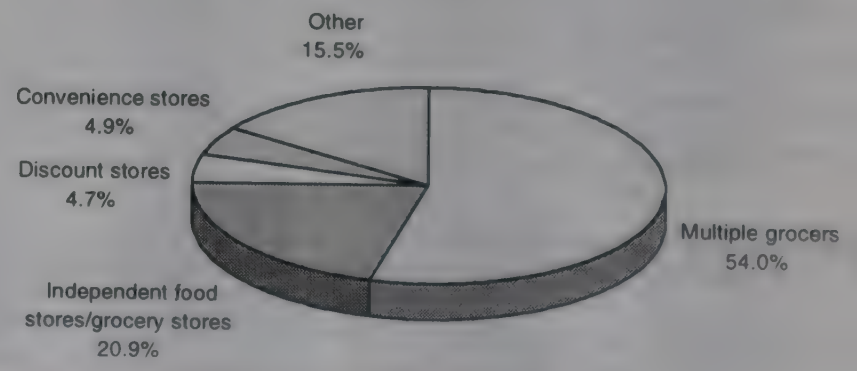
- The most prominent trend of 2000 was the development of functional dairy products with added health benefits, such as those containing added nutrients, and fermented milk products that reportedly aid digestion and natural defences.
- The rapid development of fermented or "probiotic" milk drinks has eroded sales of other dairy products such as milk and yoghurt.
- Organic dairy products continue to develop in all sectors as a result of consumer concern over food safety, particularly in the light of the growth of genetically modified foods.
- Long-life/UHT continues to gain share at the expense of fresh and powdered milk in a number of markets round the world due to its convenience, and improvements in taste as a result of technological developments.
- However, in some markets with a tradition of daily milk consumption, such as the UK and the US, it has failed to make a significant impact due to its perceived inferior taste.
- In most countries, a trend away from full- fat milks towards semi-skimmed and skimmed varieties has occurred as a consequence of increased awareness of health and nutrition.
- The powdered milk and condensed/evaporated milk sectors have been sluggish in recent years, due to a decline in home cooking, combined with a rise in liquid milk consumption in developing markets as a result of better refrigeration facilities.
- Flavoured milks showed healthy growth over the review period, underpinned by new product development (such as fruit combinations) and repositioning in some markets as an adult-orientated drink.
- Cream has benefited from developments in low-fat varieties or availability in different formats, particularly crème fraîche, as a result of the popularity of Mexican cuisine.
- Butter has seen the rapid development of spreadable formats, and creamier and higher quality varieties.
- In general, soft cheeses have gained share at the expense of hard and processed cheeses, although their development varies from market to market.
- Italian cheese such as Mozzarella and Parmesan have benefited in many markets (including Japan) from trends of increasing popularity towards Italian cuisine.
- In the cheese sector, a number of products have been positioned as convenience foods. These include cheese snacks for children (such as Kraft's Dairylea Lunchables and Golden Vale's Cheestrings in the UK), and a variety of shredded cheese products in the US.

Distribution Trends

- Distribution of dairy products is more limited than most shelf-stable products, due to the requirement for refrigeratio facilities, and the limited opportunities for impulse purchasin in this sector.
- On a global level, multiple grocers grew to represent mo than half of dairy products' sales (54%) by 1999.
- Supermarkets and hypermarkets have benefited from the growing network, their favourable prices and a wide choic of dairy products available both over the counter and off-th shelf.
- Grocery multiples are also able to offer a wide range private label dairy products, which are often cheaper tha branded products and are just as sophisticated in develope markets.
- Supermarket networks still remain in their infancy in number of emerging markets, which prevents nationwid distribution of dairy products in countries such as China an India. However, grocery multiples are expanding rapidly i these markets
- Convenience stores are another growing retail format i many parts of the world, although their range of dair products is often limited due to the necessity for prope refrigeration facilities.
- The shares taken by both specialist dairy shops an independent grocery stores declined slightly during th review period, due to inflexible opening hours and relativel high prices.
- In markets with a tradition of doorstep delivery of milk, such as the UK and the Netherlands, this is declining in favour o retail sales, due to higher prices and higher numbers o working women. However, this is a growing concept i newer markets such as Japan.
- Private label dairy products have reached high penetration levels in a number of markets, particularly the UK and US where they have become highly sophisticated.

Distribution of Dairy Products by Channel 1999

% value share



Corporate Developments and Positioning

- There are several different categories of dairy companies including private companies (e.g, Nestlé, Parmalat), co operative groups (e.g, Dairy Farmers of America, Friesland Coberco) and Statutory Export Marketing Boards (e.g, the New Zealand Dairy Board).
- The dairy industry has undergone a dramatic rationalisation process in recent years, which has seen a high level o merger activity among co-operatives.
- The removal of the New Zealand Dairy Board as part of the country's dairy deregulation process, did not take place as planned in September 2000, due to the failure of the leading co-operatives to agree on the value of their companies.
- The world's leading dairy companies are from diverse origins reflecting the still regional nature of the dairy market, thoug most global players are European.
- There are only four truly global dairy players, namely Nestlé Philip Morris, Parmalat and Danone. Nestlé and Philip Morris are diversified food groups producing exportable dairy products. while Danone and Parmalat are more focused dairy specialists with other food operations.

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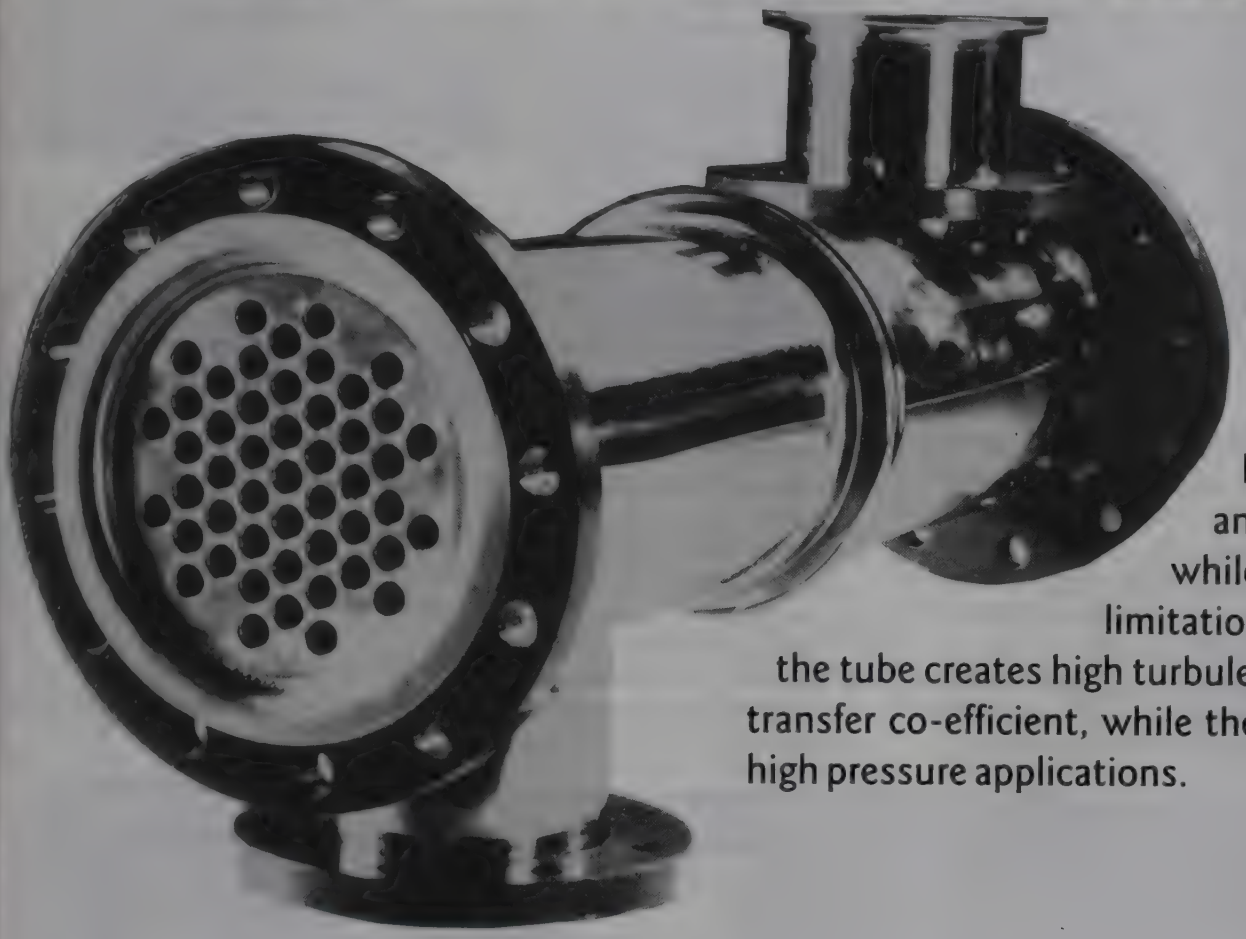

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Comparative advantages of ECOFLUX* CTHEs over conventional heat exchangers...

Advantages	Corrugated Tube Heat Exchanger	Shell & Tube Heat Exchanger	Plate Heat Exchanger
Heat Transfer Coefficient	High	Low	Very High
Uniform temperature distribution	Yes	No	Yes
Compact size	Yes	No	Limited
Ability to withstand high temp./high pressure	Yes	Yes	No
Gasket limitations	No	No	Yes
Maintenance cost	Low	Low	High
Processing of products with solid particles	Yes	Yes	No
Processing of highly viscous products	Yes	Limited	No
Ideal for aseptic processing	Yes	Limited	No

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- Other regional and national players are mainly dairy specialists competing in most product segments, which have often diversified slightly into other related food sectors. These include Dean Foods, Meiji and Suiza.
- There is considerable growth potential among the smaller companies that have managed to achieve some degree of internationalisation, such as Arla Foods (formerly MD Foods and Arla) and Lactalis, which have ambitious expansion plans and an impressive product mix.
- Some companies appear to be focusing on more profitable sectors than dairy products (Borden exited completely from the dairy market in 1998), while others are concentrating on dairy products as one of their core product areas (eg Danone).
- A number of companies have grown considerably or expanded internationally through aggressive acquisition strategies. These include Parmalat, Dean Foods and Suiza.
- The major dairy companies have also been very active in forming alliances and joint ventures in order to pool their resources or enter new markets.
- Most companies have focused on cost-cutting measures combined with new product development and increased investment in marketing in order to compete in today's competitive environment.

Branding Developments

- Of the world's largest dairy producers, only Nestlé and Philip Morris operate a variety of global, regional and national brands, having acquired many of their strong local brands
- There is a tendency towards globalisation of core brands, although this is relatively difficult in the dairy market due to its regional nature. Parmalat in particular focuses mainly on its eponymous brand name around the world.
- International branding is most developed in the processed cheese sector, where three of the global brands are owned by Philip Morris (Kraft, Kraft Singles and Philadelphia).
- Most global brands in the powdered and evaporated m subsectors are owned by Nestlé.
- In the butter sector, a number of smaller companies ha managed to achieve global brands status, such as the Ne Zealand Dairy Board's Anchor brand, and Président a Bridel from Lactalis.
- The dairy market has been characterised in recent years companies reinventing themselves to create a strong brand image and improve international recognition. This the case of Besnier and Avonmore Waterford, whic changed their names to Lactalis and Glanbia respective in 1999.
- Some companies are profiting from their strong brand equitie by cross-branding into related product sectors. For exampl the Morinaga brand in Japan was extended into the read to-drink tea and chilled desserts sectors, while Philip Morr has introduced Philadelphia Snack Bars, a cheesecake ba concept, in the US.
- Some manufacturers are using character merchandising a a method of attracting young people to impulse purchase of dairy products. These include Meiji's licensing of Pokemo (Pocket Monster) characters on its packaging, A and M Foods' use of Thomas the Tank Engine and Barbie.

Key Production Issues

- Although the number of dairy manufacturers has contracte considerably due to rationalisation within the industry production capacity continues to increase and improve i efficiency.
- Dairy manufacturers must keep abreast of technologica developments in plant and equipment in order to survive th competitive environment, and to meet strict hygiene an environmental regulations.
- World production of cow's milk and butter remained fairl stable in volume terms over the 1995-1999 period, accordin to USDA estimates.

- The only sectors to have witnessed significantly increasing production levels by volume over the review period are cheese (+10.1% by volume) and whole milk powder (+13.5%).
- There is little international trade in dairy products - particularly milk - due to the limited shelf-life of most fresh products. New Zealand is the world's largest exporter of butter and cheese.
- The EU is a significant exporter of butter to Russia, and has suffered severely from the decline in demand from Russia since 1998 as a result of its financial and economic problems.
- International price trends have little effect on most OECD countries, as domestic dairy prices are supported through a combination of import restrictions, minimum price support, government purchasing, and subsidised disposal of surpluses.
- The EU dairy industry is supported by the controversial Common Agricultural Policy (CAP). This aims to balance the need for cheap, plentiful European-produced food with the need for a steady income for farms by imposing production quotas, and allowing farmers and processors to achieve target prices.
- As the milk quota system was due to end on 31 March 2000, the EU dairy reform was passed in March 1999. This extended the milk quota regime deadline to the end of March 2008, increased quotas by more than 2% and made cuts in support prices.

Opportunities and Threats

Opportunities

- Innovation will be the key to sustaining the dairy products market in developed markets, and the future will see further development of premium and value-added products in these markets.
- The growing popularity of ethnic cuisine and foreign foods will favour the development of certain dairy products, such as crème fraîche and Italian cheeses.
- Continuing demand for more nutritional foods will also create opportunities for the development of functional dairy products, lower-fat products and organic dairy products.
- New technologies and progress in the area of UHT milk, semi-skimmed milk and low-fat dairy products will lead to improved taste and a renewed interest by consumers in these products.
- There are further opportunities to create packaging formats and products that respond to demands for convenience, environmental awareness and eating on the move. This includes the development of ready-prepared products, single portion sizes and resealable packets.
- There will be more opportunities for manufacturers to add value by targeting individual sections of consumers by age group and of lifestyle.
- As sporting events continue to be popular, and children are increasingly motivated by film and TV characters, this will allow dairy manufacturers to market their products by way of sponsoring and character licensing deals.
- Rationalisation, portfolio streamlining, strong marketing and globalisation of brands will allow dairy companies to become more focused in the future and build strong brand equities.
- There is an opportunity for companies to expand the foodservice side of their dairy business, due to general trends towards eating out, and the high demand for dairy products such as processed cheese in the fast food industry in particular.

Threats

- While many economies are beginning to recover, certain markets are still experiencing severe problems, such as Russia, which will continue to damage sales in those markets.
- There continues to be some major barriers to entry in many emerging markets, such as political and economic problems, poor infrastructure, complex legal systems and the reluctance to allow foreign infiltration.
- Increasing consumer preoccupation with health issues does not favour the development of dairy products in general, which are often cited as being the cause of high cholesterol levels.
- Changing lifestyles, including growth in snack foods and fast food, and a decline in home cooking, also do not augur well for the development of retail sales of dairy products.
- Margins are low in the dairy industry, and many markets are mature and highly competitive.
- Milk, and particularly flavoured milk drinks, will continue to be adversely affected by the growth of more popular children's soft drinks (including new varieties such as Procter & Gamble's Sunny Delight).
- Private label brands are likely to increase their penetration in most markets, and are threatening branded products in more sophisticated markets by introducing value-added and original products.
- The changes made to the EU's CAP system in 1999, i.e increased quotas and cuts in support prices, will inevitably lead to a rise in production and further pressure on EU prices.

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Changes in UHT Processed Milk

by
K. Kondal Reddy

Introduction

The growth of ultra high temperature (UHT) sterilization process of milk has been tremendous for the last two decades all over the world. There is also a great potential for expansion of UHT processed milk in developing countries with tropical regions, where the cold chain for milk distribution is not very well developed and/or is very expensive to maintain. The advantages of UHT milk for these countries are possible reductions in transport, distribution and storage costs and the control of regional and seasonal fluctuations in production. However, UHT milk produced in these countries has a very short shelflife – about 15 to 30 days compared to at least three months in advanced countries. Major problems reported in UHT milks were early gelation and off-flavour development.

Processing effects

The major effects of UHT processing include destruction of micro-organisms and changes in proteins, flavour, colour and nutritional value. At UHT temperatures the bactericidal effect increases faster than chemical reactions, producing a sterile product. Some heat resistant spores such as *Bacillus stearothermophilus* may survive, but are usually unable to reproduce under normal conditions. The principal processing induced change to milk proteins is the denaturation of whey proteins and release of sulphydryl groups, giving rise to a cooked flavour. However, denaturation of whey proteins does not affect the nutritive value of milk. Casein micelles may be changed in size distribution in milk after UHT treatment.

Freshly processed UHT milk is sometimes criticised for its cooked flavour. However, this flavour diminishes with the oxidation of sulphydryl groups, if optimum oxygen content is allowed to remain in the package. The removal of sulphur compounds in UHT milk is also possible using sulphydryl oxidase. The separation of sulphydryl oxidase from whey, its immobilization and use for the improvement of UHT milk was reviewed by Swaisgood ***et al.*** (1988). The steam infusion (milk into steam) method of UHT process developed by DASI, was claimed to be as good as pasteurized milk in relation to flavour. Hardham (1988) discussed the advantages and drawbacks of various new processing techniques for UHT treatments, but was critical about the claimed flavour advantages of DASI milk.

UHT processing increases the reflectance, making milk whiter due to the denaturation of whey proteins. Availability of lysine is reduced as a result of Maillard reaction, but to a very small extent. UHT processing also causes losses of some vitamins including vitamin C, B_{12} and folic acid while other vitamin losses are reported to be minimal (Oamen ***et al.,*** 1989).

Deposit formation on heat exchangers is a major problem observed during UHT processing of milk. The pH and mineral balance of raw milk, together with heat treatment of the process, influence the formation of deposits. The amount of deposit formed increases substantially when the pH of the processed milk is below 6.60 (Patil and Reuter, 1988).

Storage changes in UHT processed milk and age gelation

Certain chemical and biochemical reactions continue during storage, producing changes in physico-chemical properties of

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UHT milk. Primarily, Maillard reactions and enzymatic reactions of heat resistant proteases and lipases cause the changes. Some vitamin losses occur during storage if the package contains excessive oxygen. Water soluble vitamins are more prone to oxidative changes, whereas fat soluble vitamins are fairly stable. Secondary changes produced as a result of storage include age gelation (increased viscosity), colour changes (browning), increased sedimentation, loss of protein stability and stale flavour development. These changes may eventually make UHT milk unfit for human consumption.

Age gelation

The problem of age gelation has been an important factor in acceptance of UHT milk. UHT milk increases in viscosity during storage until a gel is formed. The mechanism for age gelation is not fully established. However, factors such as the raw milk quality (pH and bacterial count), severity of heat treatment, storage temperatures and heat resistant bacterial enzymes are believed to be responsible (Harwalkar, 1982). Age gelation in UHT milk appears to be a two stage mechanism in which proteolysis is followed by non-enzymic physico-chemical changes. Though UHT milk is sterile even after gelation, it is not acceptable for human consumption due to its poor physical and flavour status. UHT milk stored for a long time may be fit for drinking if it satisfies the conditions of pH > 6.5, acidity < 0.19, free tyrosine < 30 mol/100 mL and protease activity < 5 nmol mL^{-1} h^{-1} (Ito, 1985).

Effect of proteolysis

Age gelation is a complex biochemical process in which the milk proteases are considered to play a major part due to residual activity after heat treatment or reactivation during storage. It was claimed that age gelation in UHT milk was caused by proteases, through a mechanism in which enzyme triggered primary protein degradation was followed by a secondary aggregation reaction (Mitchell, 1986). Besides the bacterial proteases, a native milk enzyme, plasmin, released by mammary tissue, also affects the quality of UHT milk (de Koning ***et al.,*** 1985).

Effect of storage temperatures

Temperature of storage is said to have an effect on the physical properties of UHT milk, particularly on gelation time, colour and flavour. It was reported that the storage at elevated temperatures above room temerature, prolongs the onset of age gelation. Refrigeration temperatures of storage extend the shelflife and gelation time with least changes in physical properties (Reddy ***et al.,*** 1991).

Protein polymerization takes place in UHT milk during storage at all temperatures (as observed by the gel filtration technique). A higher proportion of protein appears to exist as covalently bound polymers at higher temperatures and long storage periods. The α_{s1} -casein was suspected to be involved in polymerization with β–casein causing a gel. Electron microscopic studies revealed that higher storage temperatures of UHT milk produce more cross linking and more aggregation (Andrews ***et al.,*** 1977). However, this polymerization effect was not reflected by viscosity changes, which should have been greater at higher storage temperatures. A satisfactory explanation for prolonged gelation time at higher temperatures was given by Samel ***et al.,*** (1971), who claimed that browning reactions at higher temperatures appeared to block the lysine residues taking part in protein-protein interactions and thus prevent the age gelation. Though higher storage temperatures may prolong the gelation time, however, they could have unfavourable effects on organoleptic quality. Therefore, 25°C temperature and below was recommended to be a reasonable temperature to store UHT milk.

Effect of processing temperatures

The increased severity of UHT process, either as a result of increased sterilization temperature or holding time, results in prolonged gelation time. Increased whey protein denaturation as a result of greater process temperatures, could retard the gelation process. Denatured β–lactoglobulin forms a complex with caseins during UHT treatment as a result of SH group formation, and such a stable complex would be expected to resist the attack of heat resistant proteases (Hong ***et al.,*** 1984). However, increased severity of heat treatment produces thermal damage to the milk constituents and affects the flavour of the product.

Concluding remarks

More wide spread use of UHT milks and a variety of other milk products can be expected throughout the world. Specific emphasis should be given for producing highest quality UHT milk to improve the shelflife and subsequent consumer acceptability. Considerable care is required at all stages of production, namely the selection of raw milk, heat processing, packaging and storage. The raw milk should have low bacterial counts, good flavour and optimum pH (> 6.6). In many developing countries, with tropical climates, poor handling of raw milk followed by cold storage for extended periods, may result in high psychrotrophic bacterial counts. Psychrotrophic bacteria produce heat resistant enzymes which may cause off-flavours and age gelation in UHT milk. The advantages of UHT milk are negated if poor quality of raw milk causes high enzymatic activity in the final product.

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DR. PRUTHI 'S AWARDS OF HONOUR

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Role of Different Macromolecules in Flavour Generation

by
Dr. Sumit Arora*, Dr. J.S. Sindhu and S.K. Nayak

Introduction

Sensory properties of food are generally grouped into three categories (i) Appearance (ii) Flavour (iii) Texture. Flavour is one of the most important sensory properties and is used by the consumers for judging both quality and variety of food product. International Standard Organisation has defined "flavour as complex combination of olfactory, gustatory and trigeminal sensations perceived during testing. Hall (1968) has defined flavour" as the sensation produced by material taken into mouth, perceived principally by the senses of taste and smell and also by general pain, tactile and temperature receptors in the mouth. The flavour of dairy products originates from microbial, enzymatic and chemical transformations. These transformations give rise to a series of volatile and non-volatile compounds, some of which correlate well with some typical flavour notes or flavour defects. Volatile components identified in dairy products can be assigned to two main sources, namely milk aroma itself and degradation of milk constituents (lactose, fat, protein) during manufacture.

Role of lipids in flavour

The role of milk fat is recognised as important for different sensory attributes of dairy products. Too high or too low a fat level leads to poor quality. Flavour of milk fat is very complex and can't be duplicated. Milk fat is important for some of its intrinsic qualities e.g. Cheddar cheese made with vegetable or mineral fat does not develop the right flavour and moreover, the quality of the cheese is not optimal if the milk fat is structurally modified by mechanical action before being reincorporated in the milk (Foda ***et al.,*** 1974).

Free Fatty Acid (FFA)

Milk fat also serves as a precursor of flavour compounds. The importance of FFA which differs considerably in chain length and flavour intensity, varies between products, but as a whole FFA are more often a source of problems than a factor of quality e.g. in cow's milk the presence of even a small amount of short chain of FFA leads to an easily perceived rancid flavour, whereas in goat milk the FFA is responsible for a specific flavour, which fetches it an important premium. FFA (mainly short chain ones) is responsible for hydrolytic rancidity, which is still an important problem for Dairy Industry. FFA may develop during frozen storage, as a result of microbial lipase activity, which has been shown to resist even severe heat treatment. Usually, FFA is the most abundant component in the flavour extracts from cheeses. Individual FFA are found in nearly the same ratio as the acids esterifies in triglycerides except for butyric acid, which is released in larger amounts, because of relative activity of milk lipase. Although volatile FFA have been considered to be the backbone of cheese aroma, no correlation could be found between flavour quality and FFA content in soft ripened cheeses. Besides, a direct negative influence on flavour, too high a FFA level may have an adverse effect on cheese quality by inhibiting some microorganisms responsible for biosynthesis of other important flavour components.

Ghee owes its pleasing flavour to the presence of 16 fatty acids C_4 to $C_{18:2}$ (Singhal & Jain, 1973). The lower fatty acids C_6 – C_{12} though present in low concentration accounting only 5–10% of total FFA, contribute significantly to the Ghee flavour.

Hydroxy Acids and Lactones

Milk fat contains small amounts of δ-hydroxy acids, which in certain circumstances spontaneously lactonise to form the corresponding δ-Lactones. Unsaturated C_{18} fatty acids may lead via hydration to hydroxy acids, which via β-oxidation lead to γ-Lactones, these also occur in butterfat. Lactones contribute significantly to the flavour of fat-based dairy products especially the heat processed one (Wadhwa & Jain, 1989). The amount of lactone precursors present in milk varies with feed, season, breed & stage of lactation. They also contribute to butter flavour. When milk fat is heated the lactone level increases and some unusual unsaturated lactone e.g. Bovalide, Dihydrobovolide have been reported. Addition of microbial lipase accelerates the lactone production and thus flavour is enhanced. Among the dairy products, Ghee owes, its unique flavour to a variety of lactone. Delta lactone are the major components in Ghee, the chief components being -C_{10}, C_{12}, C_{14}, C_{16} & C_{18}. Gamma lactones are the minor components (Wadhwa & Jain, 1984). Lactone level in ghee is three times that in butter oil which shows that lactones contribute significantly to the flavour of Ghee. Lactones are commonly found in cheese, even numbered δ-lactones with chain lengths ranging from C-8 to C-14 have consistently been identified in cheese. However, lactones found in butter and cheeses are probably formed through hydrolysis and subsequent cyclisation of the hydroxy acids.

Compounds arising from Fatty Acids

Methyl Ketones (MeK) are common constituents in most dairy products. They may be formed either by decarboxylation of oxyacids, which are minor components of milk fat or by enzymatic oxidative decarboxylation of alkanoic acids. The first mechanism, which is greatly favoured by heating, may explain the increasing level of MeK in milk as the heat treatment becomes more severe. Unsaturated ketones have also been found in cheese, e.g. 8 nonen -2- one in blue cheese and mould ripened cheeses together with undecenone and tridecenone in Camembert. Alkan -2-ones or Methylketones are reported in several dairy products especially heat processed. They are now regarded as integral components of good quality butter and ghee. These compounds are important in development of cooked flavour in foods in which butterfat is used as shortening. The level of alkan -2-one in ghee (87%) is much higher than that of butter oil (62%) (Gaba & Jain, 1976).

Compounds arising from oxidation

In most dairy products oxidation leads to off-flavour, it is only in a limited number of cases that oxidation accounts for the formation of volatile compounds which add to the quality. Oxidation of products such as butter or milk powder fat during storage has been shown to be autocatalytic (Hall ***et al.,*** 1985). Straight chain aldehydes provide a greater contribution to flavour e.g. Propionaldehyde. Oxidation can also be initiated by exposure to natural or artificial light. In milk the light induced flavour is related to methional.

Role of protein in the flavour

Protein seems to play a capital role in the development of flavour in protein rich foods such as cheese, since proteolysis leads to the formation of important non-volatile and volatile compounds. The volatile components originate from protein degradation via two main pathways.

1) Maillard browning reactions, resulting in Pyrazines and Furans
2) Degradation of Amino Acids.

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Peptides
In cheese, bitterness results from the presence of low molecular weight hydrophobic peptides arising mainly from casein. Among the different caseins α 5, casein produces more bitterness than β casein. Although bitterness appears in all dairy products, it has been studied extensively in Cheddar and Gouda cheese. The bitterness in cheese is attributed to the accumulation of bitter compounds in the peptide fraction (Creamer ***et al.,*** 1985). The reason for the presence of bitter peptide in cheese could be due to the inability of peptidase-deficient starter strains to degrade the bitter peptides to non-bitter peptides and amino acids.

Amino acids
They play a key role as precursor of a large number of flavour compounds.

Ammonia, amines and amides: All these compounds have been identified in cheese and contribute to flavour in a significant manner.

Aldehyde, alcohols & phenols: Aldehydes may appear in cheese together with alcohols from amino acids via the strecker degradation. Phenyl ethanol and phenylacetyldehyde give unpleasant flavours, the latter also contributing to an astringent bitterness, 3-methyl butanol, 2-methyl butanol, 2-methylpropanol and methanol have been described as unclean, harsh and dull flavour (Dumont, 1974). Phenol and Indole are formed from Tyrosene & Tryptophan, respectively by loss of Alanine moety. These compounds and their homologues p-cresol and skatole contribute significantly to the flavour of soft ripened cheese and sweet cream butter.

Branched chain fatty acids: Strecker aldehydes may be further oxidised to acids. These acids, which have a lower threshold value than the straight chain ones could be of importance in the flavour of these cheeses. This explains the occurrence of volatile iso-acids, which have been repeatedly identified in surface-ripened cheese.

Sulphur compounds: These are the decomposition products of sulphur amino acids cysteine and methonine and are responsible for typical flavour of dairy products but in some cases lead to typical flavour defects. Hydrogen Sulphide, formed in milk upon heating, is responsible for the cooked flavour in UHT milk and sometimes in butter (Badings & Neeter, 1980). Upon severe heat treatment other sulphur components such as methanethiol may also be formed. Methanethiol and H_2S are also formed during cheese ripening from cysteine and methionine. Methanethiol has been shown to play a very significant role in the flavour of cheddar cheese. Dimethyl sulphide which is a normal component of raw milk, if present at too high level, leads to an unclean flavour. Several sulphur compounds have been identified in mould-ripened cheese e.g. H_2S, dimethyl disulphide, demethyl trisulphide and methionol. Other compounds are also present in traces e.g. 2,4,5 trithiahexane; 3-methyl thio -2,4 -chthia pentane. The exact role of each of these compounds remains to be clarified (Dumont, 1976).

Pyrazines: It appeared that some Pseudomonas strains are able to synthesize both methoxy and alkyl subsituted pyrazines. Dimethyl pyrazine has been found in Parmesan cheese, several alkyl pyrazines were identified in Emmental and Gouda. Acetyl pyrazine and 2 methoxy -3 ethyl pyrazine are important in flavour of old cheddar cheese.

Role of lactose and citrate in flavour
The lactic flora activity leads to a series of compounds, which are important to most dairy products.

Lactic Acid: It creates acidity in various cultured products followed by a pH drop which determines the basic structure, characteristic of each cheese variety. Lactic acid may also lower the proteolytic and lipolytic activities at least in soft ripened cheeses, and lactic acid has thus an indirect but essential influence on the degradation of the main cheese constituents, which ultimately will influence the formation of flavour compounds. Lactic acid also serves as a substrate for various microorganisms such as moulds and propionibacteria which converts lactate to propionate, that is responsible for the sweet taste usually found in Emmental and Gruyere cheese.

Acetaldehyde: It is a characteristic activity of lactic streptococci and is the most abundant volatile compound in Yoghurt. In Yoghurt, the acetaldehyde level differs greatly with different strains.

Diacetyl: It is an important flavour constituent of cultured products. It is formed from citrate present in milk by *S. diacetylacitis, Leuconostoc citrovorum* and other organisms, which utilise citrate. It strongly contributes to acid cream butter flavour, a very high level leads to flavour defects. It plays a major role in unripened soft cheese e.g. cottage cheese. Diacetyl is easily reduced to acetoin which is also present at relatively high level in cultured products. This compound can be further reduced to butylene glycol, which can lead to 2-butanone as a result of *L. plantarum and L. brevis* activity.

Conclusion
Among compounds arising from fat degradation FFA appears to be important as precursors of flavour compound such as methyl ketones or as precursors of compounds arising from oxidation which may have negative or positive effect. Protein degradation at least in cheese is the main route to flavour formation of essential volatile compounds such as sulphur compounds but also to non-volatile compounds. The lactic acid determines the final flavour quality of ripened cheese, besides lactic acid, the lactic flora produces acetaldehyde and diacetyl which play major role in flavour of dairy products.

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Status of Dairy Industry in India

by
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Introduction

The importance of dairy sector in the Indian economy can be gauged from the fact that milk is the single largest item, which is estimated to fetch Rs. 450 billion, way ahead of rice and wheat. The estimated value of milk animals alone is around Rs. 35 billion. Dairy animals also contribute to industrial skin and dung valued at Rs. 60 billion.

Dairy sector provides additional income and generates job opportunities for 80 million farmer families. More than 70% of marginal farmers and landless labourer maintain dairy animals to supplement their income. Women contribute 71% of the labour force to dairy as compared to their share of 33% in crop farming. India now stands number one in milk production in the world for the last consecutive years pushing USA behind.

The annual output of dairy industry is Rs. 1,05,000 crore. Production of milk rose from 20.7 million tonnes during the year 1969–70 to 74.3 million tonnes during 1998-99 and 77.4 MT in 2000-2001. The organised sector handles only 15%, rural producers retain 40% which is still handled by traditional sector, out of 15% handled in organised sector, only 50% of it i.e. 7.5% of the total milk production is handled by private sectors.

In India, 52% of milk is produced by buffaloes, 45% by cows and only 3% of the milk is contributed by other species namely goat, sheep etc. India has the largest bovine population of 20.20% in the world.

Operation flood has played a wonderful role in the development of dairying. There are more than 97,000 milk cooperative societies in 264 districts as per AMUL pattern and at present the growth rate of this sector is 6.5% per annum. India's dairying has not matched in the world. The figures are simply amazing. For example 70 million farmers, maintaining a herd of 100 million, 57m. cows, 37m. buffaloes, fed largely on crop residues, starting as a trickle of one-2 litres per family in 500,000 remote villages as unique collection system has now transformed this feed into staple food of 100 million litres for urban consumers everyday.

Though India is world No. 1 in milk production, milk availability is as low as 216 gm per person per day. Dairying has made rapid strides but animal productivity remains low, average 1.5 litres/day.

Only 12% of total milk produced in the country is processed in 567 dairy plants for conversion into fluid milk and milk products, valued at Rs. 6934 crores annually. The contribution in value addition from the manufacture of dairy products is only 5.38% of gross output against 12.12% achieved in the food processing sector (CSO, 1996). This meager value addition is in the organised sector.

Verma and co-workers (1999) have studied the productivity performance of dairy industry, across the country and have registered an annual growth of 17.14 percent for the country as a whole with market share of 23.49% by Maharashtra followed by Gujarat (17.22%) while Bihar had the least, 1.02 percent. On the other hand, value addition as a proportion of output ranged from minus 4.79 percent for West Bengal to 17.16% for Punjab against national average of 7.22%. The negative sign for West Bengal reflects excess use of inputs more.

Though growth in the number of dairy factories outstripped the growth in milk production and significant regional disparity in the dispersion of dairy factories has been observed (Verma ***et al.***, 1999). Density of dairy factories has been increased in all states except Bihar, Kerala, Maharashtra and West Bengal. Verma ***et al.,*** (1999) suggested that management of inputs and product mix contribute significantly in productivity realization. Our strength lies in the fact that we are the largest producer of buffalo milk in the world. Its whiteness appeals to customers. Its high calcium content makes a much firmer curd and it alone can produce good mozzeralla cheese. The Italians pay a premium for the milk so as to have good quality Mozzarella cheese.

Present Scenario

On the consumption side, 44 percent of the total production was consumed in the rural sector either as liquid milk or alternative local conversion into products. The remaining 56 percent was consumed in the urban sector. The pattern of consumption is shown in Table 1.

Table 1: Consumption and Value of Milk & Milk Products 1997-98

Products	Quantity ('000 MT)	*MT equivalent ('000 MT)	Per day
Liquid milk	32,447	32,447	45.7
Buttermilk/Separated milk	24,100	24,140	34.0
Ghee**	986	–	–
Makkhan (Butter)	33	–	–
Dahi (curd)	4,899	4,899	6.9
Khoa & Condensed Milk	980	4,615	6.5
Milk powder Including infant milk	243	2,627	3.7
Paneer, Chhana & Cheese	218	1,349	1.9
Ice cream & Kulfi	54	426	0.6
Cream	18	142	0.2
Others (Milk equivalent)	–	355	0.5
Total		71,000	100.0

* MT = Million tonnes

** Ghee (27.5%) and Makkhan (6.5%) are derived during the production of buttermilk/separated milk. Some quantity of ghee is also obtained during the manufacture of SMP.

Source: Milk production in 1997-98. Annual Report, Department of A.H. & Dairying, Ministry of Agriculture, Govt. of India. Pattern of Consumption Dairy Indian, 1997.

By far the major part (84.3%) of liquid milk consumed in urban areas is supplied by the traditional or unorganised sector of Dudhiyas and milk shops. In the organised sector, while cooperative dairies sell 90 percent of the milk they process as liquid milk, the private sector converts 80% of its throughout into products. The organised sector processes milk in 370 milk plants and product factories and are growing at an average annual rate of 10-15%. In the last 25 years its throughput has increased by six times. The average installed capacity of dairy plants has increased form 10,000 to 20,000 litres per day in the 1970s, to 500,000 litres per day and finally to 1 million litre per day in the 1980 and 1990s. India's first automated dairy plant of 1 million litres per day capacity, the Mother Dairy at Gandhinagar in Gujarat was commissioned in 1996. Amul-III, which with its Satellite dairies has a total installed capacity of 1.5 mlpd, was commissioned in 1997.

Of the liquid milk consumed in India, a substantial, part is used for whitening coffee or tea. For the economically weaker sections, this accounts for almost all milk consumed. The fat content of milk is not of much consequence for this usage, hence the sizeable demand for lower cost toned and double toned milks. The volumes of different types of milk marketed by cooperative sector is shown in Table 2.

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Table 2. Dairy Milk Marketing in Urban areas

Type of Milk	Fat %	Quantity (000 litre/day)
Double Toned	1.5	448
Toned	3.0	2,911
Standardised	4.5	1,791
Full cream	6.0	504
Total		5,654

Source: NDDB. 2000

India has made praise worthy innovations in liquid milk distribution systems, sachets and bulk vending have replaced bottles, lowering and eliminating packing costs. Currently, sachets account for 82% and bulk vending for 14% of the milk sold.

As seen from Table 1, 95% of organised sector products are accounted for by liquid milk, ghee, butter, dahi, khoa and paneer, all being traditional. The remaining accounts for the Western products such as table butter, cheese, baby foods, casein, lactose, WPC, DCP and milk powder, dairy whiteners, coffee whitener, tea whitener, etc. gaining importance especially among urban consumers. These products also have export potential.

Ghee is the most important dairy product of India. The ghee produced by our dairy plants in no way reaches the texture and flavour of traditional ghee which collects a premium price.

Amul and Anand Pattern

India's white Revolution had its origin in single small enterprises started in Gujarat State. In 1946 at the suggestion of Sardar Vallabhbhai Patel, a farmer in Kaira district formed a cooperative union to supply milk directly to the Bombay Milk Scheme (BMS), cutting out private dairy and middlemen who were the main suppliers of BMS. The Kaira union began with two societies and daily milk collection of not more than 200 litres of milk. Under the chairmanship of Shri Tribhewandas Patel right from the inception of the dairy cooperative itself, a vital, link was established between the producer and Bombay's market, ensuring the incentive of a stable remuneration to the farmer. The structure of the Anand pattern was established from the beginning. Initially it included two tiers, the Primary Village Dairy Cooperative Societies with a clensten of such societies, forming the District Milk Producer Union entrusted with procurement and processing. From the modest beginning in 1946, Kaira District Cooperative Milk Producers Union, or Amul as it became popularly known has made exceptional progress. By the year 1965-66 Amul has 518 DCS with 110,000 members, it collected 65,905 tonnes of milk and could process 500,000 litres of milk per day. It sold products of total value of Rs. 92.2 million. These products ranged from milk and baby food, whole milk SMP, condensed milk, ice cream and cheese etc.

Support Role of NDDB in Operation Flood Program

Operation flood, the program to replicate Anand and create a flood of milk in India's villages, was launched in 1970. In the last 30 years, since the launch of Operation Flood, national milk production has increased more than triple fold and per capita availability almost doubled. A robust infrastructure with rural processing capacity of 19.4 mlpd and 6.7 mlpd equivalent of chilling capacity to ensure good quality of milk had been set up. For the urban consumers milk marketing facilities of 7.2 mlpd are in operation. Operation flood program was financed by funds generated from the gifts of butter oil and SMP from the World Food Program and the European Economic Community.

Today Operation Flood (OF) is a huge undertaking involving (in 1998-99) 10.1 million farm members supplying an average of 13,659 MT of milk per day through more than 81,000 cooperative societies to 170 milk producer unions who process and market it as liquid milk and processed products.

NDDB provides extensive support for their successful performance. It coordinates its activities with those of the Technology mission for Dairy Development and other government agencies. NDDB assists the unions in recruitment and training of personnel, technical help is provided in design and selection of equipment as well as in construction of dairy plants on turnkey basis.

Cheese and Fermented Milk Products

Fermented milk products have been shown to have therapeutic, anticholestrolemic, anticarcinogenic, properties with presence of probiotic microorganisms. Among fermented dairy products, cheese, dahi, lassi, shrikhand, yoghurt, misti dahi, etc. occupy special place. Currently an estimated 12,000 tonnes of cheese is being produced in our country including processed cheese, Cheddar cheese and Mozzarella cheese.

Lassi is a fermented milk beverage, which is very common all over the world. To meet the requirement of lassi all round the year, lassi powder has been developed which can be stored for up to 30 days at 30°C and for 60 days at 8°C. Lassi powder can be reconstituted with water to form ready to drink beverages, Misti dahi is popular in eastern parts. The shelf stability of misti dahi is 12 days. Shrikhand is indigenous fermented milk product popular in western parts of India.

Table 3. Region wise distribution of Milk Production, Human Population and Per Capita availability

Region	Population (million)	Milk Production (mm)	Per capita Availability (g/day)
Northern	261.9	29.4	308
Western and Central	202.8	14.0	184
Southern	212.8	13.5	174
Eastern	235.9	9.4	109

Source: Dairy India 1997.

The pattern of milk utilisation for various diary products has been shown in Table 4.

Table 4. Milk utilisation pattern (%) in India

Milk Products	1951	1995
Liquid milk	39.3%	45.7%
Ghee	39.3%	27.5%
Butter	6.0%	6.5%
Khoa	4.4%	6.5%
Dahi	8.8%	6.9%
Others	2.85	4.95

Source: Dairy India 1997.

Formulated Products

A process has been developed for low fat spread, which is spreadable at ambient as well refrigerated temperatures. It serves as good substitute for butter. Butter and cheese flavoured spread contained respectively, 40.6 and 40.4 percent fat, 5.1 and 7.9 percent protein, 8.8 and 6.3 percent carbohydrates, 2.8 and 3.0 percent ash, 42.6 and 42.4 percent moisture and calorific value of 421.5 and 420.0 Kcal/100g compared to 730 for butter.

Existing infant formula being currently marketed in India do not affect the bioprotective features that are essential to protect the health of bottle fed babies. Thus resulting in higher instances of diarrhoea among bottle-fed babies. To meet the requirements a wide range of infant formulations such as Bifidus containing infant formula, low lactose formula and preterm infant formula have been developed.

It is well known that the lactose enzyme is deficient in some of the world's population. Undigested lactose causes increase in Osmolarity, bloating, flatulence, abdominal cramps, diarrhoea and loss of appetite. In order to overcome these problems low lactose milk and low lactose powder has been developed using B-galactosidase enzyme and ultrafiltration process, respectively.

Processing parameters have been standardised for the manufacture of cakes mixes using milk by-products as egg substitute. The dry mix of the most acceptable by-product cake contained 12.0% WPC-60, 20.3 percent sugar and 2.9 percent baking powder. Technologies have been developed for whey-based soups and fruit beverages from paneer and cheese whey. Cheese whey is preferred for soups while paneer whey is suitable for the preparation of beverages. Various formula-

tions with vegetable solids and whey have been used for the development of mushroom soup, tomato soup, potato soup, potato-carrot-tomato soup and spinach-soup. Similarly, various formulations with fruits and whey have been successfully utilised for manufacturing good quality beverages.

By-product Utilisation

In India, a significant quantity of edible casein is produced. Our dairy plant mainly handles buffalo milk which results in lumpier and harder casein curd, low protein and high ash and free acidity in final product. The technologies have been developed for manufacture of casein and caseinates from buffalo milk.

Methods have been standardised for manufacture of BIS grade edible casein from buffalo milk and mixtures of buffalo and cow milk. Efficient skimming milk and the precise control of pH and temperature of precipitation are key parameters to produce good quality product. Control of agitation throughout the process is essential for good recovery of the product. The product made by the new technology is in conformity with the prescribed standards in terms of physico-chemical and microbiological qualities. On an average the product contained 8.21% moisture 2.30% ash (on dry basis) 0.082% acid in soluble ash (on dry basis) 1.17% fat (on dry basis), 15.68% nitrogen (on dry basis), 10.1 ml today acidity. The product has a shelf life of 12 months at 30°C

Whey is the by-product obtained during the manufacture of cheese, paneer, chhana, casein and other coagulated products. It constitutes nearly 50% of the nutritionally superior milk constituents. In order to ensure better utilisation of whey, processes have been optimised for the manufacture of whey powder, whey protein concentrates and lactose employing membrane technology which is less energy intensive and more cost effective process.

WPC is mainly used as ingredients in non-dairy products but also in dairy products like infants and weaning food, chemical feedings, fruit juices drink combination, etc. In order to derive maximum benefit from whey a technology has been developed for the production of whey protein concentrates by employing ultrafiltration technology.

The process for manufacture of WPC involves pretreatment and ultrafiltration of whey followed by spray drying of UF retentate. The pH of whey obtained from Cheddar cheese is adjusted prior to heating. Whey is cooled to 50°C and ultrafiltration carried out. The retentate is spray dried using 180°C inlet and 80°C outlet temperature. Whey protein concentrates powder so obtained is cooled to room temperature, packaged in polyethylene or metalised polyester packaging material.

Lactose is a major constituent of milk (4-5%). It is in substitutable product in the pharmaceutical industry and an essential input in homeopathic drugs. Besides, lactose finds usage in baby food, bakery, confectionery, ice cream and many food recipes. During the manufacture of cheese, casein, co-precepitates, paneer and chhana, a large volume of whey (80-90%) is generated; 70% of the solids, of which is lactose. Whey utilisation for lactose manufacture not only accrues economic benefit but also helps alleviate the BOD level of the effluent. Lactose manufacture in India will help substitute import which is over 5000 tonnes per annum at present.

The processing parameter for UF of cheese and paneer whey and reverse osmosis of the ensuing permeate have been standardised. The recovery is about 70%.

Present status of traditional dairy product

The organised dairies in India handle and process about 12-15% of total milk produced. Although authentic statistical data are not available, it may be estimated that about 34 million tonnes of milk is converted into traditional products annually in India.

Classification of indigenous milk products

A variety of indigenous milk products are produced in India. Most of them are region specific. The market demand, quality of milk, economics of operation and shelf life determines the type of products to be manufactured and marketed. The list of such products commonly produced in given in Table 5. The products can be classified into 7 major kinds based on the different processing technologies viz.

1. Heat concentrated or desiccated products
2. Heat and acid coagulated products
3. Fermented products
4. Fat rich products
5. Frozen products
6. Cereal milk mixes
7. Milk sweet, confectionery and novelties

The indigenous dairy products are produced by small scale traders and halwa is except for about 15% of total ghee which is contributed by the organised dairy plants.

The unhygienic conditions at the production units lead to contamination of products, with different types of micro-organisms leading to low shelf life of the base products, problem gets aggravated during summer in respect of composition, microbiological quality, sensory properties, and shelf life. A variety of microorganisms comprising of millions of mesophiles acid producers, spore formers, conforms, staphylococci, yeasts and moulds can be found in the products.

Table 5. List of Common traditional Indian milk products

Process	Product	Western Counterparts
Concentration	Khoa, Basundi, Rabri Khurchan Malai	Evaporated milk Sweetened Condensed milk
Coagulation	Chhana	Direct acidified cheese Latin American
	Paneer	White Cheese
Fermentation	Dahi	Plain Youghurt
	Payodhi	Sweetened-yoghurt
	Misti-dahi	Cultured milk/ butter milk
	Chakka Srikhand Lassi, Chhach	
Phase inversion effect	Makhan Malai/Loni	Butter
Fat dehydration Freezing	Ghee	Butter-oil
	Kulfi Kulfa Malai-Ka-burf	Ice-cream, and other frozen desserts

Table 6. List of some milk based delicacies

Khoa based	Chhana based	Cereal based
Variety of Burfi	Rosogolla	Kheer
Peda	Sandesh	Paysam
Kalakand	Pantoa	Phirni
Gulabjamun	Ras-Malai	Mihidana
Palangtod	Cham-Cham	
Malai-Laddoo	Rajbhog	
Kunda/Doodh Pak	Chhana-murki	
Milk cake	Lalmohan	
Carrot-Halwa	Totapuli	
Gourd Halwa	Chitrakoot	
Malpo		

Modernisation and upgradation of techniques

Industrial methods have been developed during the last 10 years for mechanised production, packaging and storage of khoa, chhana, ghee, dahi, gulabjamun, burfi, peda, rasogolla, kalakand and shrikhand. These products are now produced regularly on a factory scale, many of these products are stored and transported in refrigerated conditions and packaged in food grade plastic containers.

The production of traditional milk products by using modern methods would promote the utilisation of larger quantities of milk during the flush season and help in stabilising milk pricing.

Application of recombined milk technology traditional products can be used in lean months and in the milk deficient zones.

The recent development in mechanisation and automation of technologies for convenience traditional products like khoa, powder, rasogolla mix powder, gulabjamun mix powder, kulfi mix powder, chhana powder, shrikhand powder, etc. with prolonged shelf life and high consumer acceptability have further supported the modernisation efforts of this sector to a great extent.

Strengths

Manpower – We look at our population merely as a problem but it is a major resource considering the labour intensive nature of dairying.

Table 7. An optimistic demand profile

Product	Current Demand 1998 (MT)	Projected Demand 2009 (MT)
Ghee	1,00,000	2,00,000
Cheese	4,100	15,000
Paneer	1,000	16,000
Shrikhand	3,000	5,650
Rosogolla	1,600	6,000
Gulabjamun	3,000	5,850
Yoghurt	375	800

Source: GCMF-TCS, Survey report

The consumption of traditional dairy products is likely t grow at an annual rate of more than 20%.

Table 8. High profit Margins

Product	Raw material cost as percentage of sale price
Paneer	65
Sandesh	39
Peda/Burfi/Kalakand	35
Gulabjamun	34
Rosogolla	33
Shrikhand	29

Source: Aneja, 1995

Opportunities

Vast scope for innovation, burgeoning consumer base an export potential. Thus the combined effect of our strengths an opportunity is manifold, what we now need is to evolve aroun 4 Fs, First, Fast, Focussed and Friendly.

Conclusion

WTO is committed to establish an open and liberal globa environment. In India where lot needs to be done to cope up wit SPS measures, TBT and Codex Alimentarius. At the same time w cut cost all levels, attaining international parity to quality and foo safety of the product and considering global competition wit domestic consumer on our part of industry, we have to gear up to

- Improve productivity at all levels and cut down cost.
- Improve images and a reliable supplier of safe and quality milk products conforming to codex standards in duly certifie premises under 150-9000 HACCP based system.
- Project buffalo milk products as value added premium products. Recently government of India could negotiate the buffs on SMP at 15% for the first 10,000 metric tonnes an 60% thereafter. By this step Dairy Industry is also protected. The need for mechanising and upgrading the technology o production, packaging, preservation and distribution of milk products is greatly realised.

Attempt to develop any large scale process for milk based sweets must aim at using the already existing processes in food plants rather than relying on a new plant design and fabrication which carry limitation of available engineering skill, high cost of time loss. In view of great demand for dairy products specially indigenous products there is great scope of modernization o the existing technology for industrial operation. Many new processes like Membrane process, High pressure technologies have been developed in recent past should be implemented. High ambient temperature and relative humidity greatly contribute to the spoilage problem, 5-10% of total milk solid in India. Great scope exists for improving shelf life of milk sweets by employing few of the many approaches such as modifie atmospheric or vacuum packing, use of humicants, LP system chilling van and permitted preservatives etc.

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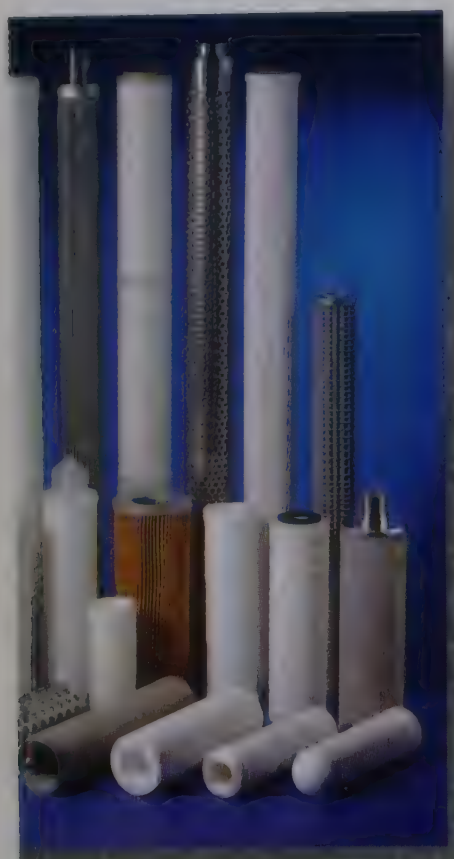

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Siddharth Ads

Whey and Lactose Processing

by
Dr. P. Caimi

1. Whey and Lactose — General Features

A. Chemical Composition of Whey

Whey is a by-product from cheese or casein manufacture: it is the fluid obtained after separating the coagulum of whole milk, cream or skim milk.

Worldwide, whey processing is still relatively new: about 20 years ago, more than two thirds of whey production was disposed off as waste and much of it is unfortunately still wasted.

Most whey products of commerce are generated from processing cow and goat milks, whose typical composition, together with that of woman, is reported in the following table:

Milk Average Composition Percent

Species	In Milk							In Total Solids				
	Water	Fat	Protein	Lactose	Ash	Non-fat solids	Total solids	Fat	Protein	Lactose	Ash solids	Non-fat solids
Woman	87.4	3.8	1.6	7.0	0.2	8.8	12.6	29.8	13.0	55.5	1.7	70.2
Cow	87.2	3.7	3.5	4.9	0.7	9.1	12.8	28.9	27.3	38.3	5.5	71.1
Goat	87.0	4.3	3.5	4.3	0.9	8.8	13.0	32.7	27.1	32.9	6.6	67.3

There are two types of whey: "Sweet whey" and "acid whey".

Sweet whey results from the manufacture of products that principally use rennet type enzymes at about pH 5-6. Acid whey occurs where the coagulum is formed by acidification in a pH range of about 5.1 or below.

Whey is a dilute liquid containing lactose, proteins, minerals and traces of fat and contains approximately 7% of total solids of which 60-75% is lactose and 11 ÷ 17% are proteins; the mineral content in sweet whey would test about 8% and 10% in acid products.

The lower lactose content results from the lactose being converted into lactic acid, while the higher mineral level is due to more of the calcium being solubilized by acidification. Other details are reported in the following two tables.

Typical Whey Solution Composition

Components	Whey type: Cheddar cheese
Total solids	66 – 71 g/kg
Protein	8 – 10 g/kg
Fat	1 – 4 g/kg
Lactose	46 – 50 g/kg
Ash	3.7 – 6.5 g/kg
Potassium	1 – 2 g/kg
Sodium	0.2 – 0.4 g/kg
Calcium	0.3 – 0.6 g/kg
Magnesium	0.1 – 0.3 g/kg
Phosphate	1 – 3 g/kg
Chloride	1 g/kg

General Composition Percent of Dry Wheys

		Sweet-Type Dry Whey		Acid-Type Dry Whey	
		Mean	*Range*	*Mean*	*Range*
Lactose	%	69.4	59.9 ÷ 74.6	63.2	58.8 ÷ 71.7
Total protein	%	13.0	11.1 ÷ 16.6	11.7	8.0 ÷ 12.6
Non protein nitrogen	%	0.5	0.2 ÷ 0.7	0.6	0.5 ÷ 0.7
Fat	%	1.0	0.4 ÷ 1.5	0.5	0.3 ÷ 0.7
Total ash	%	8.3	7.1 ÷ 10.7	10.6	7.3 ÷ 12.2
Moisture	%	3.7	1.8 ÷ 6.7	4.6	3.3 ÷ 6.5
pH	%	5.9	5.2 ÷ 6.4	4.6	4.4 ÷ 4.8

Typical Whey Solution Mineral Composition

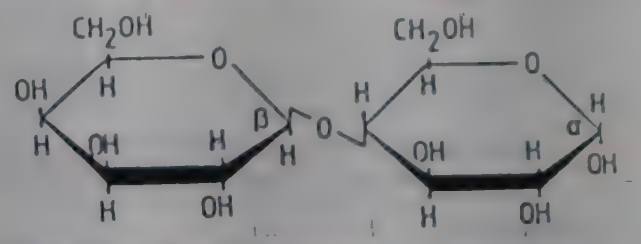
Whey type	Ca (ppm)	Mg (ppm)	Na (ppm)	K (ppm)	P (ppm)	Zn (ppm)	Fe (ppm)	Cu (ppm)	Mn (ppm)
Acid	930	90	400	1530	580	2	1	0.07	0.03
Sweet	370	70	460	1230	430	0.1	0.09	0.04	0.01
Dry acid	14500	1450	7600	23400	4650	45	6	0.5	0.2
Dry sweet	4700	1000	7500	23400	5800	2	3.5	0.7	0.1

R&D Manager, Mitsubishi Chemical Div of Mitsubishi Chem. Corp. Resindion S R L. Paper for publication submitted by their Official Indian Agent: Pharmaconcept, Mumbai

B. Chemical Composition of Lactose and Lactose Derivatives

Lactose is the major carbohydrate in the milk of most mammals, being synthesized in the mammary gland from galactose and glucose.

Lactose is a disaccharide called 4-O-beta-D-galacto-piranosil-D-glucose. The structure is the following:



C. Lactose Main Features

Lactose occurs in both alpha and beta forms; it is not as sweet as sucrose, glucose and fructose.

Relative sweetness of sugars is shown in the following figure:

Concentration (%) to give same sweetness

Sucrose	Fructose	Lactose
0.5	0.4	1.9
1.0	0.8	3.5
2.0	1.7	6.5
5.0	4.2	15.7
10.0	8.6	25.9
20.0	16.7	33.3

Most of the chemical reactions of lactose involve one or more of the following:

- the 1-4 linkage between the galactose and glucose units (hydrolysis)
- the reduction of the aldehyde group of the glucose unit (lactitol)
- the hydroxyl groups of both the glucose and galactose units (tartaric, oxalic, gluconic, galactonic acid)
- the carbon to carbon bonds.

Lactose is decomposed by heat under acidic and basic conditions:

- under acidic conditions lactose undergoes hydrolysis to glucose and galactose, that both can dehydrate to HMF
- in neutral and basic conditions, the principal decomposition products formed are relatively strong acids like formic acid.

A major practical result of heating lactose-containing products under severe conditions is the formation of products from browning reactions.

In the browning of food products there are three general mechanisms:

1. caramelization or non amino-browning of sugars
2. amino-sugar reactions such as the Maillard reaction
3. oxidative browning

Since caramelization requires a very high activation energy, the most common cause of browning is the Maillard reaction. In lactose containing products the reaction involves the formation of a Schiff base between an amino group and the aldehyde of the glucose molecule of lactose.

The asymmetric carbon atom of the number 1 carbon of lactose results in two possible anomers, which are designed alpha and beta. A solution of lactose has an optical rotation of 56°, derivating from a ratio of 1.68 beta to alpha form (alpha form 88° and beta form 34°).

Solubility is relatively low if compared with other sugars, this affects the use of lactose in food products because of the tendency to crystal formation.

D. Whey and Lactose Utilization

Whey products used in human foods

	Conc. whey	Dried whey	Reduced lactose and reduced mineral whey	Whey protein concentrate	Lactose	Other
% on total amount	7%	64%	6%	6%	9%	8%
Infant foods	–	-	40%	3%	39%	–
Dairy	68%	35%	39%	66%	6%	–
Dry blends	–	19%	9%	13%	–	–
Bakery	17%	26%	6%	4%	8%	–
Prepared dry mixes	8%	14%	1%	4%	5%	–
Chemicals/ pharma	–	–	–	2%	23%	–
All others	7%	6%	5%	8%	19%	–
Total	100%	100%	100%	100%	100%	

Functionality and benefits from using whey and whey products are the following:

Ice Cream and Frozen Desserts :
a) Whey can replace 25% of milk solids non fat (MSNF)
b) demi whey powder increases viscosity and decreases saltness.

Bakery : a) Whey improves crumb structure and tenderness.

Confectionery : a) Whey improves nutritional quality.

Beverages : Acid whey is especially compatible with the formulation of:
a) fruit flavoured beverages
b) yogurts flavoured whey
c) "whey wine" containing more than 10% alcohol
d) fruits flavoured whey beverages.

Meat Products : Whey is used to control flavour and cooking losses in sausage products.

Animal Feed :
a) ruminants can consume 30% of their day matter requirements in the form of liquid whey, while pigs 20%.
b) ammonium lactate, produced by fermenting whey, can be also used as animal food (big potential)

Functionality and benefits from using lactose and lactose derivatives are the following:

Ice Cream and Frozen Desserts :
a) Lactose reduces sweetness, enhances aromas and improves mouth feel.
b) Hydrolyzed lactose reduces the problem of lactose crystallization.

Bakery : Lactose develops a golden brown crust.

Confectionery : Lactose reduces sweetness and improves shelf-life

Yoghurts : Hydrolyzed lactose reduces the time to reach the end pH, improves the organoleptic features and confers a smoother body

Cheese : Hydrolyzed lactose increases the ripening time, favours a firmer coagulum, develops flavour and body, confers a more elastic and resistant curd and facilitates mould development.

Butter : Hydrolyzed lactose assures decreased coagulation time.

Pharmaceutical Industry :
a) lactose is the best carrier for tablets and acts as a substrate for penicillin and other fermentation products.
b) Hydrolyzed lactose is suitable for lactose maladsorbers.

To underline also the growing use of:
— lactitol in particular for diabetic products, low calories slimming products, low calories tablets for sweeteners and sweets that are safe for teeth;
— lactulose for the beneficial effects to the large intestine.

2. Whey and Lactose Production

World-wide production of whey appears to be of the order of more than 100 million tons. This amount is estimated on the basis of world cheese production in 1987, and considering that:
— each kg of cheese produces about 7.3 kg of whey as by-product;
— cheese production increases at a rate of 3% per year.

Cheese and whey world wide production ('000 Tons)

	Cheese 1987	Production 1997 (forecast)	Whey 1987	Production 1997 (forecast)
EEC	4500	600	33000	44000
USA	2850	3800	23000	31000
CANADA	300	400	2500	3400
NEW ZEALAND	200	270	1700	2300
AUSTRALIA	200	270	1700	2300
Other OECD	700	900	5000	6700
Other COUNTRIES	5000	6700	37000	50000
TOTAL	13750	18400	103900	139000

Only about 50% of the total whey production in EEC and USA is dried or further processed into other products, with the only exception of Holland, where this percentage is much higher.

2.1 Description of the Main Whey Processes

A] Processing Prior to Concentration
— Clarification by settling / screening / centrifugation or by centrifugation alone
— Separation of fats by self discharging separators (residual fats level: 0.06%)
— Pasteurization at 70-75° C for 15 – 20 s.

B] Concentration Processing
— Reverse Osmosis: R.O. is limited by the viscosity of the retentate to a solids content of 20 – 22%. For this reason, it is used for preconcentrating whey prior to evaporation.
— Evaporation to 40 – 60% dry substance: It is done by means of a falling film evaporator. Whey at elevated temperature is distributed evenly over the inner surface of a long vertical tube and flows down a thin film under vacuum. Multiple tubes are used.

C] Dried whey production

Direct drying of concentrates yields powders that are very hygroscopic, with danger of lacking powder on storage. It is important to encourage the majority of the lactose to crystallize into the alpha-lactose hydrate form, that can be concentrated to 55 – 60% D.S. before being spray-dried.

Typical saturated solution of lactose is >55% D.S. at 38°C; there are two processes for lactose crystallization: traditional (batch mode) and "short time" (continuous).

Exit chamber moisture is 6 – 7%: final drying takes place in a vibrating fluid bed with the three stages: ambient air – 100°C – dehumidified air at 10 – 11°C.

Agglomeration process is completed in an "automizing zone" that also reduces dustiness and improves the powder dispersibility.

D] Deproteinated whey and UF permeate production

Deproteinated whey is manufactured by heating at 70 – 80°C to denature proteins, followed by acidification and removal of the flocculant by decantation, filtration and centrifugation.

UF permeate is the major by-product of UF whey for manufacturing Whey Protein Concentrates (WPC).

These two liquids contain about 90% of the total solids of the original whey and have a great potential as a source material for many manufacturing processes.

E] Whey protein concentrate (WPC) production

WPC is obtained applying the following processes (singly or in

sequence) to remove low molecular weight materials from whey:
— Heat coagulation
— Gel filtration
— Electrodialysis
— Polyphosphates precipitation

F] Hydrolysed whey production

Lactose hydrolysis can be catalysed enzymatically or by heating at 140°C in presence of strong mineral acids pH 1.2 – 1.5 or by a treatment with a strongly acidic cation exchange resin in H form.

Hydrolysis increases solubility and decreases viscosity of whey and UF permeate syrups: for this reason, whey syrups can be concentrated to 60 – 70% solids in vacuum evaporators without crystallization problems. However, lactose hydrolysis products (glucose and galactose) become sticky and hygroscopic in spray driers, making it difficult to dry. Therefore, concentrated syrups are preferred over powder forms.

Immobilized enzyme technology has been used to improve the economics of lactose hydrolysis (immobilized lactase enzyme).

2.2 Description of the Main Lactose Processes

A] Lactose refining

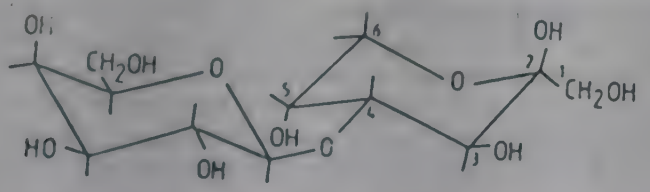
Lactose is manufactured by concentrating whey, deproteinized whey or UF permeate to 50 – 65% D.S. and cooling to 86°C or lower temperature with agitation to promote crystallization.

The alpha monohydrate crystals are recovered by decanting, centrifugation and washing with water to yield crude lactose that can be further purified to obtain "USP" grade lactose. In refining, activated carbon and/or ion exchange resins are applied.

After refining, the solution containing 30% lactose is then filtered with the asistance of a filter aid and the resulting solution is then concentrated to about 70%.

B] Lactose alkaline hydrolysis to lactulose

Lactulose is an isomer of lactose in which the galactose moiety is linked to fructose by beta 1-4 glycosidic linkage.



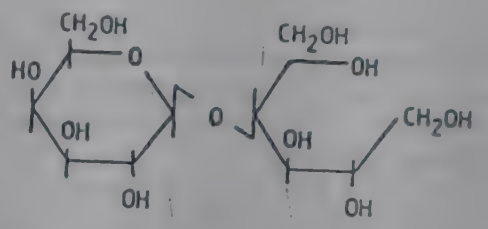
This sugar plays an important role in infant nutrition by promoting the growth of a particular bacterium in the large intestine.

Lactulose production is catalyzed by lime or other alkaline hydroxides; other methods employ boric acid + trymethylamine or ion exchange resins.

Enzymatic processes for producing lactulose have also been devised. Purification of lactulose is also done by using a bi-functional boron resin, followed by treatment with a second boron resin on a polystyrene matrix to remove galactose.

c] Lactose hydrogenation to lactitol

Lactitole is produced by catalytic hydrogenation of lactose in whey or whey permeate and has the components galactose and sorbitol, this last being formed by hydrogenation of the glucose moiety of lactose.



It is less hygroscopic than sorbitol and xylitol. From this point of view, it is similar to mannitol.

Sweetening power is 0.4 compared with a value of 1 for sucrose.

Lactitol is more stable than lactose to pH and temperature, and has the same flavour of sucrose.

D] Lactose Hydrolysis

To overcome the difficulties due to:
— the low level of lactose solids in milk, whey and permeate
— its cost ineffectiveness as a feedstock for many fermentation processes
— the low selling price for purified lactose
— the high BOD of lactose stream making disposal difficult and expensive

An opportunity is given by lactose hydrolysis.

In this process, lactose is converted to its two components, glucose and galactose; this technique can be applied to all lactose containing fluids, including milks, wheys and UF permeates.

Lactose conversion is carried out by the enzyme lactase; in man, lactase activity is high at birth but declines thereafter, undergoing in some cases fermentation and generating acids, CO_2 and H_2. These effects are responsible for many of the symptoms shown by lactose malabsorbers.

Lactose hydrolysis can be carried out very effectively and economically under conditions of low pH and high temperatures. The adjustment of pH can be made either by direct addition of acid to the system, or by treatment of the product with the cation exchange resins.

The products are typically brown and may require neutralization, demineralization and decolorization before use.

To be underlined that commercialization of these processes can be inhibited by the cost of the product compared with those of its main competitors, sucrose and starch hydrolysates.

There are three major enzyme techniques which may be used for lactose hydrolysis:
— soluble single use enzyme systems
— enzyme recovery systems
— immobilized systems

In the soluble single use system, the enzyme is added directly to the reactor, in such an amount as to obtain the required degree of hydrolysis within the given holding period.

An alternative approach is to use a continuous stirred reactor, in which feed and enzyme are continuously added to the reactor, and the hydrolysed product is continuously removed. This batch processing is widely used thanks to its simplicity and flexibility.

The drawbacks are: high cost and enzyme loss in the product.

In the enzyme recovery system, the reactor is equipped with membranes to recover and reuse the enzyme. Membranes allow lactose / glucose / galactose to pass through whilst retaining the comparatively high molecular weight enzyme.

Such systems are operated in a steady state operation and are characterized by high complexity and costs.

In the immobilized systems, supports that are likely to be useful in commercial operation should:
1. be of significantly higher or lower density than the substrate;
2. have a very even particle size;
3. be resistant to degradation by operating temperature, pH variations and cleaning regimes;
4. not support microbial growth;
5. be safe for use in food processing applications.

Most reactor systems operate at or near the optimum temperature of the enzyme, generally in the range of 30 – 40°C.

Two types of reactors can be utilized for immobilized enzyme systems:
– fixed beds
– fluidized beds

Fixed beds are simple to operate but the major disadvantage is the bacteria growth which can occur during the hydrolysis due to the presence of eventual deadspots.

Fluidized beds overcome these difficulties by ensuring that the enzyme particles are in continuous movement but are characterized by a rather high complexity.

Main immobilized systems commercially available are:
1. **Valio system**, based on enzyme obtained by A. Niger;
2. **Corning system**, based on lactase obtained by A. Niger too, covalently bound to a control for silica carrier;
3. **Sumitomo system**, based on enzyme obtained by A. Oryzae immobilized onto an anion exchange resin; hydrolysis is very quick and applicable to milk, whey and permeates;
4. **Tate and Lyle system**, based on immobilization on charcoal.

E] Lactose fermentation to biopolymers

There are several bacteria capable to ferment lactose to produce xanthan and other biopolymers.

Biopolymer production is favoured by hydrolising lactose or adding glucose to the growth medium.

F] Lactose polymerization to oligosaccharides

Oligosaccharides are incorporated in the K-casein of milk. They are produced as a result of the action of beta-galactosidase on lactose.

3. Proposal for whey and lactose demineralization

Cow's milk contains quite a high level of minerals, averaging about 7g/l; much of this mineral load finds its way into the by products of common manufacturing operations, whey and U permeates.

The high level of minerals present in such products ca restrict their commercial use in many applications.

Totally or partially demineralized wheys produced by io exchange have been developed to overcome difficulties fro the relatively high mineral content:
— salty flavour effect
— electrolyte unbalance for infant formulae
— special food products preparation

Filtered raw whey analysis

		Raw Material	
Whey type		**Sweet whey**	**Acid whey**
DS (Bx)		6.5 ÷ 7.5	6.5 ÷ 7.5
Temperature		5 ÷ 10°C	5 ÷ 10°C
Total protein	ppm	700 - 1100	500 - 800
Non protein nitrogen	ppm	10 ÷ 50	30 ÷ 50
Fat	%	0.02 ÷ 0.1	0.02 ÷ 0.05
Lactose	%	4.0 ÷ 5.0	4.0 ÷ 4.6
Conductivity	µs/cm	4.000 ÷ 6.000	5.000 ÷ 7.000
pH		4 ÷ 5	5 ÷ 7
Ash	%	0.45 ÷ 0.70	0.45 ÷ 0.80
Potassium	meq/1	30 ÷ 35	35 ÷ 45
Sodium	meq/1	20 ÷ 25	15 ÷ 20
Calcium	meq/1	20 ÷ 25	40 ÷ 50
Magnesium	meq/1	5 ÷ 10	5 ÷ 10
Total cations	meq/1	75 ÷ 95	95 ÷ 125
Phosphate	meq/1	40 ÷ 50	50 ÷ 60
Chloride	meq/1	15 ÷ 20	15 ÷ 20
Other anions	meq/1	20 ÷ 25	30 ÷ 45
Total anions	meq/1	75 ÷ 95	95 ÷ 125

Demineralized whey quality

		Sweet and acid whey
	pH	6.0 ÷ 8.0
	Conductivity	<200 µS/cm

The following important points should be noted:
— the physical conditions of the whey feedstocks is an important factor determining the efficiency of the ion exchange processes: agglomerates like casein or cheese curd fines or other suspended matters produced during pretreatments can cause serious technical problems to ion exchange resin plants; therefore, much care must be taken in applying the correct filtration procedure to upstream the plant.
— Demineralization load is higher for acid wheys than fo sweet wheys, and cyclic throughput varies accordingly. Nevertheless, this variation in the solution to be treated does not influence the profile of the demineralized product applying the right operating conditions, a minimum level of 95% demineralization is easily achieved. In case such a high purity degree overcomes the purpose of the treatment, whey can be partially by-passed in order to achieve the desired demineralization degree.
— Operating temperature is highly preferably low (5 ÷ 10°C) in order to avoid the extent of protein losses by resin adsorption and assist in the prevention of microbial growth in the system.

According to the available data, only a small part of the whey is demineralized: there is a clear application for the demineralization of lactose feedstocks prior to commencement of crystallization.

Demineralization is also used on a deproteinated whey as a pretreatment in the manufacture of lactose.

The most important application of demi whey based products is as ingredients in infant formulae; in practice demineralization of whey permits formulations of infant milks with a gross composition closer to that of human milk. A range of demineralized spray-dried whey based products for use in infant feeds and dietetic applications have been developed based on product manufactured by demineralization.

Entrepreneurship Resource Planning (ERP) In Dairy Industry

by
Pradip Narayan Das

Introduction

With the Indian companies increasingly facing competition both from other Indian companies and multinationals that are setting up shop here, the benefit of using ERP packages are fast outweighing the high cost of implementation.

In today's fast changing world, application and adoption of various sophisticated technologies are imminent. Present technologies are getting obsolete and newer technology is emerging. Various organisations in the developed countries have started adopting ERP, though 34% of the organisations having turnover of more than 600 crores only implement as compared to those having 54% less than 600 crores out of ERP adopting organisations. To improve the process of any organisation, is the main aim of ERP, which is an operation-efficiency tool.

Evaluation of ERP

1. 1960's – Mainly used for departmental application like payroll, inventory, management to automize the routine labour intensive task.
2. 1970's – Interchanging department application developed in housing by different departments in a company.
3. Late 1970's and early 1980's – Computer prices slided down.
4. 1980's – Companies recognised the need for integration resulting in integrated single application. ERP system evolved and spread across the entire corporate world like wildfire. ERP is now used in HRD, Purchase, Sales forecasting, Payrolls etc.
5. 1990's and beyond – ERP becomes more user friendly, customer needs now an added feature. Now ERP is available to reduce cost, reduce time of implementation, simpler implementation procedure.

Benefits of ERP

1. ERP integrates all kinds of data - no matter where in the organisation, it generates into single, accurate, updated body of information available to everyone, it can only work with structured, formulated objectively, verified facts and figures.
2. ERP significantly reduces the turnaround time, increases the efficiency manifold, and improves the profit margin by a tremendous amount.
3. ERP ensures the uniformity of the process all the time, help to streamline the production and leads to faster implementation of ISO certification.
4. It reduces the paper work, ensures zero duplication of effort, focuses on productivity and profitability.
5. ERP enables the management quick result-oriented decision making, thereby saving on time and energy.
6. As ERP is designed to work beyond the conventional boundaries of organisation, it improves the relationship between several departments, suppliers and customers.

Constraints in applying ERP

1. High cost of implementation is a major factor that still makes Indian companies rethink the option.
2. Total commitment and complete involvement from top to bottom level people are necessary to take the actual benefit of the package.
3. It takes long term duration for implementation.
4. It needs an active staff retention practice, not only during project implementation but also throughout the life cycle of the system. Cost of replacement of ERP is extraordinarily high compared to cost of retaining them.
5. It requires best technical people on the project.
6. Trained and well-aware consultant is necessary.

Chronology of an ERP Project (tentative)

Feasibility study/GAP Analysis	2.2 months
Project blue print/ Master plan	1.9 months
Customization of software	3.8 months
Actual implementation	5.2 months
User Training	1.7 months
User Sign-off/Handholding	0.7 months

Factors to consider the right package of ERP

Although the cost is the prime factor in selecting a particular package and its implementation, it should not become the only factor, other factors are far more important, though not easily quantifiable. These include the implementation time, scale of operation, ease of use, among others. Some other features that should be looked for before choosing a particular solution are its functionality, cost, performance, the service and support offered by vendors and amount of training needed for employers.

Vendors: Sensing further scope, vendors are busy tightening their belts and realizing their strategies to grab a piece of the pie. Vendors are well aware that greater share will go to those who offer solution-specific, user friendly and easy to implement packages, backed by superior service and support. As of now, at least a dozen vendors including SAP, Oracle, Baan, JD, Ramco, QAD, Mastek, ESS, IFS, Scala, Edwards, SSA are offering ERP solutions.

In the Indian market, SAP has been able to secure an encouraging 18-20% of the market share, closely followed by Ramco and Oracle at 12-14%. Baan has succeeded in capturing 10-12% of the market share, and is positioned third. But SAP dominates the overall worldwide trend by notching up 50% of the total market, followed by Oracle (15%) and Baan (8%).

Applicability in Dairy Industry

The main objective of ERP package is to integrate various functions/departments/divisions within an organization to enable them to operate optimally so as to reduce cost, increase profitability, and achieve the highest customer satisfaction.

The dairy segment is possibly one of the most diverse food categories, producing bulk and consumer goods, with a product set ranges from beverages to powder, solid to viscous, canned, bagged, boxed, each with unique set of requirements for successful manufacturing and supply, the common denominator being that they all start from the same raw material – wonderful milk.

A dairy company generally consists of Production department, Quality Assurance department, Purchase department, Sales/Marketing, and Services department.

Production of various milk and milk products is the main activity of the dairy as well as food industry. It is considered the central nerve system, normally headed by Production Manager, who is responsible to fulfill all the targets set by the Sales/Marketing department based on forecasting/market research. Continuous developments of new products as well as improvement in existing products are accomplished here. Nowadays, most of the production processes are dependent on automation, IT based, with simple to complex hardware/software solutions such as Computer Aided Manufacturing (CAM) and

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Fermentation of Germinated Soybean Milk with Lactic Cultures

by
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Abstract
An attempt was made to utilize soymilk made from germinated soybean, claimed to have reduced oligosaccharide content due to hydrolysis, for growth and activity of lactic acid bacteria (LAB). There was an increase in the growth (total viable count) and activity (titratable acidity and pH) of all lactic cultures used in the study, in comparison to their growth in normal soymilk. Use of germinated soybean milk is recommended for manufacture of fermented milks with less flatulence and increased acceptability.

Introduction
Soymilk is a milk-like product obtained by aqueous extraction of soybeans. The protein content of soymilk is similar to that of cow milk and an excellent source of low cost protein. But soymilk has a number of quantitative problems, which act as major hindrance in its utilization to enrich our diet with quality protein. One of these problems is its tendency to induce flatulence, often accompanied by an uncomfortable feeling of fullness and intestinal activity. Recently, it has been suggested by some investigators that the flatulence caused by soy products could be due, at least in part, to their relatively high contents of galacto-oligosaccharides, especially stachyose and raffinose (Murphy, 1963; 1964a, 1964b; Burr, 1967; Rackis ***et al.,*** 1967; Steggerda, 1967). On the basis of this hypothesis, flatulence in soymilk should be reduced by removal or decomposition of these oligosaccharides. It has been observed that during germination of soybean, the monosaccharide content increases and raffinose and stachyose disappears (East ***et al.,*** 1972; Kim ***et al.,*** 1973). Moreover, a majority of lactic acid bacteria cannot utilize the oligosaccherides stachyose and raffinose (Angels and Marth 1971). Therefore, if soymilk is prepared from germinated bean, it may be fermented with normal lactic acid bacteria and the product thus prepared ought to be less flatulent and thereby more acceptable. Consequently, the investigation was undertaken to study the growth and acid production of lactic acid bacteria in germinated soybean milk.

Materials and Methods
Collection and Maintenance of Cultures: Ten species of lactic acid bacteria were used for the present study. *Lactococcus lactis* subsp. *lactis 712*, *Lactococcus lactis* subsp. *cremoris 301*, *Streptococus thermophilus H*, *Lactobacillus delbrueckii* subsp. *bulgaricus W.* and *Lactococcus lactis* subsp. *diacetylactis DRC 1* were procured from Culture Collection Centre, National Dairy Research Institute, Karnal, India and *Lactobacillus cellobiosis* NRRL-B-184, *Lactobacillus buchneri* NRRL-B-1837, *Lactobacillus fermenti* NRRL-B-585, *Lactobacillus plantarum* NRRL-B-246 and *Lactobacillus acidophilus* ATCC-4356 were collected from Northern Regional Laboratory, Peoria, Illinois, U.S.A.

The stock cultures were grown and maintained in agar stabs of a medium containing tryptone 0.25%, yeast extracts 0.05%, gelatin 0.25% glucose 0.25%, sodium chloride 0.40% sodium acetate 0.15%, ascorbic acid 0.05% and agar 1.2%. The cultures were activated in sterile litmus milk and were maintained at 5°C between fortnightly transfer. Each culture was regularly examined microscopically for purity. A 16 - 18 hr. old culture resulting from last transfer was used in each experiment. An inocculum of 1% (v/v) was used in all tests.

Preparation of Normal Soy Milk (NSM)
Dry, whole soybean (variety Harasoy) were thoroughly washed and soaked in water at 60°C until the absorbed water was about 1 ml/g dry weight. The soak solution was decanted and the beans were washed. The beans were ground in a grinder (Phillips India Ltd.) for 5 min (3 min at low, 1 min at medium and 1 min at high speed) with boiling water. The ratio of beans to water was 1:9 w/v and the temperature during grinding was between 85 – 95°C. Use of boiling water inactivate the enzyme, lipoxygenase, which is responsible for beany flavour (Wilkens ***et al.,*** 1967). The resulting suspension was filtered. The resultant soy milk was dispersed in 160 ml screw cap bottles, autoclaved for 15 min at 15 psi and held at 5°C until use.

Preparation of Germinated Soy Bean Milk (GSM)
Germination of soybean seed was done for 48 hr. by adopting the method of East ***et al.,*** (1972). The sprout was removed from the germinated bean, washed and cleaned with tap water, dehulled and ground with water (dehulled bean to water ratio 1:4 w/v). A ratio of one part of such germinated dehulled bean to four parts of water resulted in a medium with a protein content approximately equal to that of cow's milk. The ground material was then filtered using a double layer cheese cloth. The germinated soybean milk was then filled in a 160 ml screw cap bottles, autoclaved for 15 min at 15 psi and held at 5°C until use.

Growth and Acid production
The test inocculum was prepared by transferring the cultures from litmus milk into the experimental medium and subculturing in the same medium, twice, at daily intervals. 100 ml of the experimental medium was brought to the temperature of incubation, inoculated with 1.0 ml of 16-18 hr culture and incubated at 30°C for *L. plantarum* and 37°C for the other organisms. 0.5 ml of each culture was used when growth of mixed culture was studied. Samples were withdrawn from the experimental medium at selected intervals and analysed for growth, acid production and changes in pH.

Analysis
Plate counts on Lactic agar (Elliker ***et al.,*** 1956) were used to determine changes in viable counts. Duplicate plates were incubated for 24 - 48 h at 37°C with the exception of *L. plantarum* which was incubated at 30°C. Acid development was measured by titration of 10 g of sample with 0.1 (N) NaOH using phenolphthalein indicator. Changes in pH were followed using a Beckman pH meter.

Protein was determined by a slight modification of the Semimicro Kjeldahl method (AOAC, 1995) replacing mercuric oxide and potassium sulphate with a kjeldahl tablet containing sodium sulphate and selenium as the catalyst (BDH, England). A nitrogen to protein conservation factor of 5.71 was used (Pearson, 1970). Fat, moisture and ash were determined by AOAC (1995) procedure.

Results and Discussion
The proximate composition of normal soymilk and germinated soybean milk were almost similar in terms of major constituents except for carbohydrate, which was less in case of GSM (Table 1). This may be due to the fact that during germination of beans, the soy oligosaccharides viz. stachyose, raffinose and sucrose were hydrolysed to monosaccharides like galactose and a fraction of these might have been utilized for the growth of roots and sprouts.

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Table 1. Proximate Composition of Normal and Germinated-Soybean milk

Types of Milk	Moisture %	Protein %	Fat %	Ash %	Carbohydrate %
Normal Soy Milk (NSM)	91.5	3.15	2.05	0.46	2.84
Germinated-Bean Soy Milk (GSM)	92.30	3.00	1.84	0.46	2.40

Acid production in germinated soybean milk by all the lactic cultures and their combination was higher than in normal soy milk (Table 2). *L. Acidophilus* ATCC-4356, *L. cellobiosis* NRRL-B-184 and *L. plantarum* NRRL-B-246 produced higher amount of acid in GSM (0.49 – 0.56%) than in NSM (0.40 – 0.47%). Similar changes in pH were also observed. *L. buchneri* NRRL-B-1837 and *L. fermenti* NRRL-B-585 also produced more acid in GSM than NSM but lesser than that produced by *L. acidophilus* ATCC-4356, *L. cellobiosis* NRRL-B-184 or *L. plantarum* NRRL-B-246. *S. thermophilus* H produced maximum acid (0.59%) in GSM in comparison to other cultures (0.29 – 0.53%). *Lactococcus* cultures also produced greater acid (0.35 – 0.39%) in GSM than NSM (0.27 – 0.31%). Mixed culture of *Lactobacillus* & *S. thermophilus* H also produced more acid in GSM than NSM (Table 2).

Table 2. Percent Titratable Acidity (%TA) Lactic Acid and pH of Normal Soy Milk (NSM) and Germinated Soybean Milk (GSM) inoculated with lactic acid bacteria and incubated for 16 hr.

Organism	Normal Soy Milk		Germinated Soybean Milk	
	pH	%TA	pH	%TA
Initial Range	6.50	0.14	6.50	0.13
Lactococcus lactis subsp. *lactis* 712.	5.90	0.31	5.55	0.39
Lactococcus lactis subsp. *cremoris* 301.	6.10	0.27	5.52	0.35
Streptococcus thermophilus H	4.50	0.49	4.10	0.59
Lactobacillus delbrueckii subsp. *bulgaricus* W	6.25	0.22	5.90	0.29
Actococcus lactis subsp. *diacetylactis* DRC 1.	5.60	0.28	5.26	0.37
Lactobacillus acidophilus ATCC 4356	4.80	0.40	4.53	0.49
Lactobacillus plantarum NRRL-B-246	4.42	0.47	4.06	0.56
Actobacillus fermenti NRRL-B-585.	5.90	0.25	5.54	0.33
Lactobacillus bunchenri NRRL-B-1837.	5.55	0.29	5.20	0.36
Lactobacillus cellobiosis NRRL-B-184.	4.65	0.44	4.30	0.53
S. thermophilus H plus *L. acidophilus* ATCC-4356.	4.36	0.61	3.98	0.70
S. thermophilus H plus *L. delbrueckii* subsp. *bulgaricus* W.	4.60	0.45	4.25	0.54
S. thermophilus H plus *L. fermenti* NRRL-B-585.	4.50	0.44	4.08	0.55
S. thermophilus H plus *L. buchneri* NRRL-B-1837.	4.60	0.36	4.25	0.42
S. thermophilus H plus *L. cellobiosis* NRRL-B-184.	4.50	0.47	4.10	0.55

S. thermophilus H exhibited two-fold population in GSM than in NSM (Table 3). All lactobacilli, except *L. delbrueckii* subsp. *bulgaricus* W, produced higher growth in GSM than NSM (Table 3). *L. acidophilus* ATCC 4356, *L. cellobiosis* NRRL-B-184 and *L. plantarum* NRRL-B-246 attained maximum population amongst lactobacilli in both the soymilks. *Lactococcus* cultures also exhibited greater population in GSM than in NSM media (Table 3). The mixed cultures of *S. thermophilus* H and *L. acidophilus* ATCC 4356 also exhibited higher population in germinated soybean milk (4.46×10^8 c.f.u./ml in GSM as compared to 3.90×10^8 c.f.u./ml in NSM). Although mixed culture of *S. thermophilus H* and *L. delbrueckii* subsp. *bulgaricus W* showed slightly lower population in both the soymilks, it was evident in all cases that GSM media gave better support for the growth of lactic organisms. All the lactic organisms can fully utilize the monosaccharide galactose, which had been hydrolysed from oligosaccharide during germination of soybean (East ***et al.,*** 1972).

Table 3. Growth of Lactic Acid Organism in Normal Soymilk and Germinated Soybean Milk Incubated for 16 hours.

Organism	Normal Soymilk Viable Count (c.f.u./ml.)	Germinated Soybean Milk Viable Count (c.f.u./ml.)
Lactococcus lactis subsp. *lactis* 712	4.20×10^6	4.80×10^6
Lactococcus lactis subsp. *cremoris* 301	4.10×10^6	4.90×10^6
Streptococcus thermophilus H	2.10×10^8	3.96×10^8
Lactobacillus delbrueckii subsp. *bulgaricus* W	3.70×10^6	4.10×10^6
Lactococcus lactis subsp. *diacetylactis* DRC 1	3.56×10^6	3.92×10^6
Lactobacillus acidophilus ATCC-4356.	2.28×10^9	3.00×10^9
Lactobacillus plantarum NRLL-B-246.	1.76×10^9	2.20×10^9
Lactobacillus fermenti NRRL-B-585.	4.90×10^8	5.20×10^8
Lactobacillus bunchenri NRRL-B-1837.	2.30×10^8	2.79×10^8
Lactobacillus cellobiosis NRRL-B-184.	6.10×10^8	6.59×10^8
S. thermophilus H plus *L. acidophilus* ATCC-4356	3.90×10^8	4.46×10^8
S. thermophilus H plus *L. delbrueckii* subsp. *bulgaricus* W.	6.93×10^7	7.40×10^7
S. thermophilus H plus *L. fermenti* NRRL-B-585.	3.88×10^8	4.37×10^8
S. thermophilus H plus *L. buchneri* NRRL-B-1837.	1.53×10^8	2.20×10^8
S. thermophilus H plus *L. cellobiosis* NRRL-B-184.	2.46×10^8	293×10^8

Appreciable growth and acid production by *L. acidophilus* ATCC 4356, *L. plantarum* NRRL-B-246, *L. cellobiosis* NRRL-B-184 and *L. fermenti* NRLL-B-585 in GSM media may be due to their ability to utilize the galacto-oligosaccharides as well as monosaccharides. Several investigators have also reported substantial acid production by these cultures in soymilk media (Hang and Jackson, 1967); Matsouka ***et al.,*** 1968; Angels and Marth, 1971). However, no information is available in this regard on the acid producing ability of these cultures in germinated soybean milk.

In general, the mixed cultures showed higher acid production than each of the single strain culture, thus indicating their synergistic action on acid production.

Yamanaka ***et al.,*** (1970) while utilizing a mixed culture of *S. thermomophilus* H and *L. delbrueckii* subsp. *bulgaricus* W in preparing soymilk beverage also reported similar findings.

The results of this investigation confirmed that germinated soymilk is a better media for the growth of lactic culture than normal soymilk media. Hence it can be successfully employed for manufacture of fermented soymilk products with reduced oligosaccharide content.

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Entrepreneurship Resource Planning (ERP) in Dairy Industry

Computer Aided Design (CAD) packages. Most of the testing fault finding and aligning processes have also been computer ised to achieve a high level quality of products.

Quality is the most vital aspect of milk and milk products International standards on quality management systems, such as ISO 9000, envisage quality implementation in all activities of an organisation. Specialized IT packages for the implemen tation of quality management systems in an organisation is available, and has been implemented usefully in many organi sations.

In the present scenario, IT application is highly necessary in all functions like production planning/scheduling for shopfloor manufacturing, process design. Besides this, activities like material management, inventory control, vendor developmen etc. need IT applications using appropriate hardware and software. Services cover life cycle support to all machinery including boilers, vehicles, machineries and their preventive maintenance. Since the downtime of a plant/machine can be very expensive, various manufacturing industries are going in for implementation of plant management software packages.

A good organisation considers its manpower as its most valuable asset. Therefore, in few vital aspects like recruitment training, welfare, placement, fixing of salaries, etc., use of IT products (hardware and software) are inevitable.

Presently, there is an extensive use of IT application in Sales and Marketing for business planning, promotional strategies market research, sales function etc.

Conclusion

It is clear from the above discussion that information system automation and suitable packages of ERP along with positive approach of the organisation can help dairy industry comply with government regulations and quality of their products. This also cuts costs and allows a processor to integrate information in keeping with the increasingly vertical way that the processo does business.

Broadly speaking food companies have similar IS need Technology for the dairy industry however needs to be special Systems designed for this industry should solve challenges in a cost effective and reliable manner.

Studies on the Shelf Life of Whey Based Mango Beverage

by
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Abstract
Attempts were made to develop a whey based fruit beverage from chhana whey and mango pulp. Four varieties of mango viz, Himsagar, Amrapali, Langra and Fazli were tried with different sugar levels. The whey beverage formulated by using mango pulp of Amrapali variety at 12% level with 8% sugar scored highest. Carbonated sterilized whey beverage showed better acceptability than the whey beverage treated with preservative. Carbonated sterilized beverage stored at 30°C ± 1°C counts organoleptically in good condition upto 70 days of storage whereas the sterilized beverage stored at 7° ± 1°C was found to be organolepically fit upto 80 days of storage.

Introduction
The by-product "whey" is obtained during chhana, paneer, cheese and casein production. Cheese whey accounts for the major part in total whey production i.e. nearly about 95%. In India about 80% of the total whey produced is obtained from chhana or paneer production (Gupta and Mathur, 1989). Whey contains about half of the total solids of milk (Gupta, 2000) and is a source of precious nutrients like whey proteins, lactose, milk salts and water soluble vitamins (Kravcenko, 1988).

Day by day production of chhana whey is increasing due to the increasing demand for chhana based sweets all over the country, mainly in West Bengal. Most of the whey produced is drained into gutters, which creates problem of pollution besides loss of valuable nutrients. Again the process of whey utilization involves higher processing cost and is not feasible under the present Indian economic condition. Several attempts have been made to develop acceptable low cost nutrituous whey beverage (Bambha ***et al.,*** 1972; Gagrani ***et al.,*** 1987, Mondal ***et al.,*** 1997 Khamrui and Rajorhia, 1998, Singh ***et al.,*** 1999). Present investigation was undertaken to formulate a fruit whey beverage from chhana whey in combination with mango pulp and to study its keeping quality.

Materials and Methods
Whey
Fresh chhana whey was collected from a sweet shop near the Institute. The chhana whey was separated using cream separator. The fat free chhana was deproteinized by heating at 98 ± 2°C for 30 min and kept undisturbed overnight at refrigerated temperature to allow the precipitated protein to settle down. The whey was filtered through sterilized cotton padded muslin cloth to obtain deproteinized whey.

Mango Pulp
Four different varieties of mangoes namely Amrapali, Himsagar, Langra and Fazli were tried on the basis of their pulp, colour, flavour and sweetness for the preparation of beverage. Fresh, fully ripe mangoes were washed with water, the skin was removed, fresh cut into small pieces and put in a mixer for 5 to 8 minutes to obtain a homogeneous mango pulp. The pulp was kept in the refrigerator for further use.

Preparation of Whey Beverage
Sixteen different whey beverage formulations were made for each variety of mango by using different levels of pulp (8, 12, 16 and 20%) on the basis of deproteinized whey. Benzoic acid was added at the rate of 0.05% as preservative and citric acid was added to adjust the acidity of each formulation to 0.04% (lactic acid). The whole mix was agitated by a mechanical agitator for 10 – 15 min and filtered. The products were then pasteurized, bottled, carbonated and sealed. The samples were then subjected to sensory evaluation by selected trained judges for the selection of best formulation. The carbonated whey beverage containing 12% mango pulp of Amrapali variety and 8% sugar was selected for product formulation.

Beverages were divided into four lots. The first (P_1) and second (P_2) lots were carbonated with benzoic acid and stored at 30° ± 1°C and 5°C ± 1°C, respectively. The third (S_1) and fourth (S_2) lots were carbonated (without benzoic acid), then sterilized and stored at 30° ± 1°C and 5°C ± 1°C, respectively. The control whey beverages were only sterilized and stored at 30° ± 1°C and 5° ± 1°C respectively.

Chemical Analysis
Total solids, fat, ash, protein and titratable acidity were estimated by the standard method (ISI, 1981). Lactose and sucrose were estimated by picric acid method (Perry and Doan, 1950). Viscosity was recorded using ostwald viscometer as relative viscosity.

Sensory evaluation
The stored beverage samples were subjected to sensory evaluation by a panel of trained judges (Amerine ***et al.,*** 1965).

Results and Discussion
Physico-chemical quality of the whey beverage
Compositional analysis of the beverage (gm/100 ml) showed that the fat, protein, carbohydrates (lactose and sucrose), ash and total solids values were found to be more or less similar under all the treatments (Table 1). The major component of the beverage was carbohydrate contributing more than 80% of the total solids, obviously because of presence of lactose from whey, sugars from mango pulp and fortification of sucrose. Slight increase in ash and protein content in the beverages were observed than that of deproteinized whey. It may be due to concentration of whey during deproteinization and protein from mango pulp. Acidity of the freshly prepared beverage was recorded 0.327 (% lactic acid) before the adjustment to 0.4 (% lactic acid). The specific gravity of control, carbonated preservative added sample and sterilized carbonated sample were recorded as 1.072, 1.073 and 1.074 respectively whereas relative viscosity of all the samples were 1.520 (centipoise) (Table 1).

Table 1. Physico-chemical quality of the whey beverage

Parameter	C	P	S
Total Solids (%)	17.48	17.65	17.71
Fat (%)	0.08	0.10	0.10
Protein (%)	0.22	0.21	0.20
Lactose (%)	6.21	6.24	6.27
Sucrose (%)	8.63	8.86	8.74
Ash (%)	0.49	0.48	0.49
Acidity (% lactic acid)	0.40	0.40	0.40
Relative Viscosity (Cp)	1.520	1.520	1.520
Specific gravity	1.072	1.073	1.074

Values are the average of five trials
C = Control
P = Carbonated + Preservative
S = Carbonated + Sterilized

Storage study
The chemical analysis was carried out upto the respective days of storage of different formulations till the products were organoleptically well. The chemical analysis was discontinued for the control sample (C_1), carbonated preservative added sample (P_1) and carbonated sterilized sample (S_1) after 20, 40,

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70 days of storage at 30 ± 1°C respectively. On the other hand the control sample (C_2), carbonated preservatives added sample (P_2) and carbonated sterilized sample (S_2) were analysed chemically upto 30, 60 and 80 days of storage respectively at 7 ± 1°C respectively till the products were organoleptically well.

Change in titratable acidity (TA)

The changes in titratable acidity of the whey beverages stored at 30 ± 1°C and 7 ± 1°C are shown in Table 2. The average value of TA of freshly prepared whey beverage was observed to be 0.327 (% lactic acid) before the adjustment. The TA of control (C_1 & C_2) and treated samples, P_1, P_2, S_1 and S_2 were adjusted initially to 0.4 (% lactic acid) with citric acid. The TA of all type whey beverages were found to increase with the progress of storage period. The percent of increase in TA for C_1 sample was found 60.0 on 20th day of storage, for C_2 sample was found 57.5 on 30th day of storage, for P_1 was 55.0 on 40th day of storage, for P_2 was found 57.5 on 60th day of storage, for S_1 was 55.0 on 70th day of storage and for S_2 sample was found 55.0 on 80th day of storage after which the product was found to be unacceptable. So, the rate of increase in TA was found to be higher in C_1 sample followed by C_2, P_1, P_2, S_1 and S_2. The final values of TA of treated samples P_1, P_2, S_1 and S_2 were observed to be 0.61, 0.63, 0.62 and 0.60 (% lactic acid) at the end of 40, 60, 70 and 80 days of storage respectively, till the samples were in good condition, whereas the TA of control samples C_1 and C_2 were recorded 0.67 and 0.66 (% lactic acid) after storage for 20 and 30 days respectively. This result reveals that the TA content of all samples stored at 30 ± 1°C increased more sharply than that at 7 ± 1°C, irrespective of treatment imposed. The result also points out that irrespective of temperature used the rate of increase in TA of control samples (C_1 & C_2) were higher than the treated samples (P_1, P_2, S_1 and S_2). It may be also noted from the Table 2 that sterilized samples (S_1 & S_2) showed better result than the preservative treated samples (P_1 & P_2) in controlling the TA as the rate of increase in TA was lower in the former than the latter one. It may thus be inferred that sterilization had a better capacity to retard the changes in TA as compared to others.

Table 2. Mean titratable acidity of the whey beverages during storage

Description of samples	Storage Time (In Days)								
	0	10	20	30	40	50	60	70	80
C_1	0.4	0.56	0.64	–	–	–	–	–	–
C_2	0.4	0.51	0.59	0.63	–	–	–	–	–
P_1	0.4	0.46	0.55	0.59	0.62	–	–	–	–
P_2	0.4	0.405	0.50	0.55	0.58	0.61	0.63	–	–
S_1	0.4	0.403	0.46	0.51	0.55	0.58	0.60	0.62	–
S_2	0.4	0.40	0.48	0.53	0.56	0.58	0.60	0.61	0.62

C_1 = Control sample stored at ambient temp. (30 ± 1°C)
C_2 = Control sample stored at refrigerated temp. (7 ± 1°C)
P_1 = Preservative (benzoic acid @ 0.05%) added carbonated sample stored at ambient temp. (30 ± 1°C)
P_2 = Preservative (benzoic acid @ 0.05%) added carbonated sample stored at refrigerated temp. (7 ± 1°C)
S_1 = Sterilized carbonated sample stored at ambient temp. (30 ± 1°C)
S_2 = Sterilized carbonated sample stored at refrigerated temp. (7 ± 1°C)

Change in Viscosity

The change in viscosity during the storage period is shown in Table 3. There was no change in relative viscosity for any of the samples up to 10 days of storage. The initial viscosity of all the beverages were 1.520 centipoise. The final viscosity of the samples C_1, C_2, P_1, P_2, S_1 and S_2 were observed 1.543, 1.542, 1.540, 1.539, 1.541 and 1.538 after storage of 20, 30, 40, 60, 70 and 80 days respectively. So the percent increase in viscosity of the samples C_1, C_2, P_1, P_2, S_1 and S_2 was found to be 1.51, 1.45, 1.32, 1.25, 1.38 and 1.18 respectively at the corresponding days of spoilage. It reveals that the rate of increase in viscosity was higher in C_1 sample followed by C_2, P_1, P_2, S_1 and S_2. The result shows that the increase in viscosity of the samples stored at 30 ± 1°C was faster than that at 7 ± 1°C irrespective of treatment imposed. The results also indicated that irrespective of temperature used the rate in increase in viscosity of control samples (C_1 & C_2) were higher than the treated samples (P_1, P_2, S_1 and S_2). The results are in agreement with the findings of Krishnaiah ***et al.*** (1989). They found slight increase in relative viscosity in the beverage, (without preservative) stored at room temperature than the beverage with preservative stored at room temperature or the beverage stored at refrigerated temperature without preservatives. It is further revealed in Table 3 that sterilized samples (S_1 & S_2) showed better result than preservative treated samples (P_1 & P_2) as the rate of increase in viscosity was lower in case of S_1 and S_2 than P_1 and P_2. Therefore sterilization effect appears to afford a better control on viscosity changes in the product as compared to others.

Table 3. Mean relative viscosity (Cp) of the whey beverages during storage

Description of samples	Storage Time (In Days)								
	0	10	20	30	40	50	60	70	80
C_1	1.520	1.520	1.543	–	–	–	–	–	–
C_2	1.520	1.520	1.526	1.542	–	–	–	–	–
P_1	1.520	1.520	1.524	1.531	1.540	–	–	–	–
P_2	1.520	1.520	1.520	1.522	1.527	1.533	1.539	–	–
S_1	1.520	1.520	1.520	1.523	1.528	1.531	1.536	1.541	–
S_2	1.520	1.520	1.520	1.520	1.522	1.525	1.529	1.533	1.53

C_1 = Control sample stored at ambient temp. (30 ± 1°C)
C_2 = Control sample stored at refrigerated temp. (7 ± 1°C)
P_1 = Preservative (benzoic acid @ 0.05%) added carbonated sample stored at ambient temp. (30 ± 1°C)
P_2 = Preservative (benzoic acid @ 0.05%) added carbonated sample stored at refrigerated temp. (7 ± 1°C)
S_1 = Sterilized carbonated sample stored at ambient temp. (30 ± 1°C)
S_2 = Sterilized carbonated sample stored at refrigerated temp. (7 ± 1°C

Change in sensory quality

Initial score of control samples i.e. C_1 and C_2, preservative added carbonated samples i.e. P_1 and P_2 and carbonated sterilized sample i.e. S_1 and S_2 were 7.7, 7.9 and 7.8 respectively (Table 4). There was no change in sensory score upto 10 days of storage at 7 ± 1°C. The whey beverage denoted by C_1, C_2, P_1, P_2, S_1 and S_2 remained acceptable upto 20, 30, 40, 60, 70, 80 days of storage respectively. The rate of decrease in sensory scores of the beverages C_1, C_2, P_1, P_2, S_1 and S_2 were observed 35.06, 33.76, 34.17, 32.05 and 30.76% at the end of 20, 30, 40

Table 4. Mean sensory quality of the whey beverages during storage

Description of samples	Storage Time (In Days)								
	0	10	20	30	40	50	60	70	80
C_1	7.7	6.8	5.0	–	–	–	–	–	–
C_2	7.7	7.7	6.9	5.1	–	–	–	–	–
P_1	7.9	7.6	7.1	6.5	5.0	–	–	–	–
P_2	7.9	7.9	7.7	7.3	6.7	6.1	5.2	–	–
S_1	7.8	7.5	7.0	6.4	6.3	6.0	5.7	5.3	–
S_2	7.8	7.8	7.5	7.2	6.8	6.5	6.3	6.1	5.4

C_1 = Control sample stored at ambient temp. (30 ± 1°C)
C_2 = Control sample stored at refrigerated temp. (7 ± 1°C)
P_1 = Preservative (benzoic acid @ 0.05%) added carbonated sample stored at ambient temp. (30 ± 1°C)
P_2 = Preservative (benzoic acid @ 0.05%) added carbonated sample stored at refrigerated temp. (7 ± 1°C)
S_1 = Sterilized carbonated sample stored at ambient temp. (30 ± 1°C)
S_2 = Sterilized carbonated sample stored at refrigerated temp. (7 ± 1°C

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Membrane Processing in Food and Dairy Industry — A Review

by
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Introduction

A membrane is a barrier, which is capable of redistributing components in a fluid stream through a driving force such as pressure difference, concentration or electrical potential. When a concentration or electrical potential gradient provides the necessary driving force, the separation process is called dialysis or electrodialysis, however most of the membrane processes (RO, UF, MF and NF) are based on applied pressure difference across the membrane. Depending on the size of membrane pores, the molecular sieving of constituents take place under the influence of the applied pressure difference in the approximate range of 1 to 100 bars. Depending on the pore size or porous nature of membrane structure, the pressure driven processes are classified as Reverse Osmosis (RO), Ultrafiltration (UF), Microfiltration (MF) and Nanofiltration (NF).

Reverse osmosis (RO), also known as hyperfiltration, is essentially a dewatering technique of fluids. The use of RO was first started in the 1960's after the development of synthetic asymmetric membrane by S. Sourirajan. In its initial stage the RO process was mainly used for desalination and water treatment. The process gained entrance in food industry, particularly the dairy, in the seventies and its applications increased dramatically in the 1980's. RO is now considered as the most economic process of removing water from liquid foods including milk (Cheryan, 1996).

In reverse osmosis, the membranes are very dense or non-porous (i.e. 1-10 A only) whereas in ultrafiltration and microfiltration, membranes are conveniently defined as, 'those having pore diameters in the ranges of 3-35 nm and 0.1-10 microns', respectively. Microfiltration (MF) fits between the tangential flow Ultrafiltration (UF) and is used in the separation of suspended particles in the range of 0.05 to 10μm (Bird, 1996), while ultrafiltration is a pressure driven membrane process that can be used in the fractionation, purification and concentration of the substances, having a molecular weight between 10^3 to 10^6 daltons and is used for saving on energy required processing, improved yield and enhanced nutritive value of the product.

The membrane may be made of organic (polymers) or inorganic (mineral or ceramic) material. The first semi-permeable synthetic membrane was made-up of cellulose acetate. The ceramic membranes, with a highly permeable support and a multichannel geometry with stability to heat, acid and alkali; have opened up novel applications of MF separation technology in the dairy and food industry.

The three main applications include (i) removal of bacteria (ii) whey defatting and (iii) micellar casein enrichment of cheesemilk and several other applications in fruits, jelly and other foods (Maubois, 1997). Very recently, some materials like zirconium oxide, thorium chloride, aluminium oxide and carbon have been used to make the porous membrane for wide range of applications in food and biotechnological processes. These porous membranes are called inorganic or mineral/ceramic membranes.

For application in dairy / food processing certain non-cellulosic membrane have been using a variety of synthetic materials such as nylon (polyamide), polysulphone, polyvinyl chloride, polystyrene etc. Some commercial polymeric membranes are available in the market.

A major constraint of the membrane process is the tendency for colloidal aggregates to get entrapped in the membrane pores followed by a cake formation on the surface of th membrane leading to the creation of a new dynamic membran layer, which overall changes the filtration characteristics, an rejection properties are not governed by the initial pore size the membrane (Daufin and Merin, 1995).

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Historical Background

Thomas Graham (1866) was the first person who observed tha metallic palladium can absorb a large amount of hydroge Since his observation, palladium hydride system, has bee studied extensively. Palladium based inorganic membran systems and technology have been reviewed by Armor (198 and Hsieh (1991). In addition to palladium and its alloys, othe inorganic materials have been found to be permeable only t certain gases. For example, silver and dense (stabilized zirconium are only selective to oxygen. These palladium base non-porous membranes have not been used to any significan degree in conventional separation applications, probably du to their low flux and high costs.

In addition to palladium, several inorganic materials hav been investigated as precursors for porous membranes. Man of these materials are not commercialized yet. These includ cordierite, mica, silica, silicon carbide, silicon nitride, tin oxid and titania.

Later in the 1970's Union Carbide refined the technology o Oak Ridge National Laboratories, USA for commercialization o dynamic zirconia membrane and started marketing the firs commercial membrane under the brand of Ucarsep® zirconi membrane for gas diffusion applications.

In France, alumina membranes which were originally in tended for gas diffusion had been further developed by Creave (now SCT, an Alcoa subsidiary) for commercial liquid filtratio processes. Similarly, zirconia membranes developed in US were further used for liquid filtration processes by SFEC, France with the technical knowhow of French Atomic Energy Commis sion. Now SFEC manufactures "Carbosep", the first minera membranes which are commercially available.

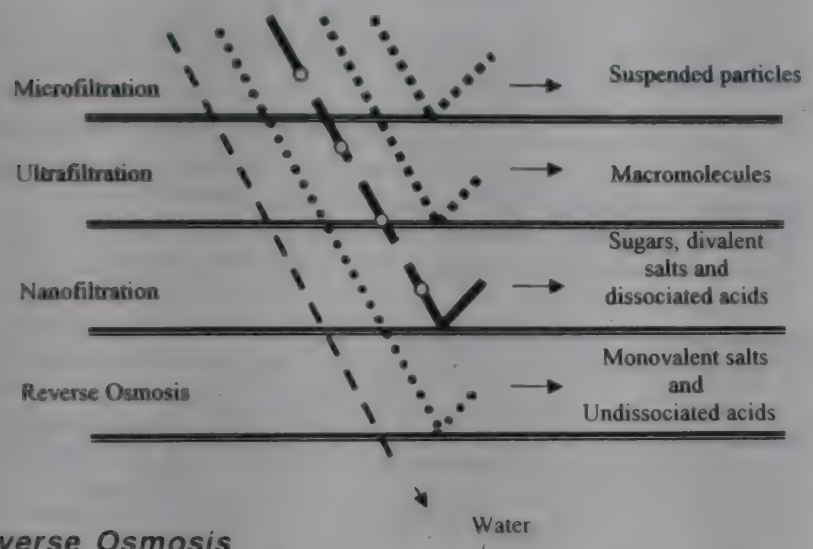
Apart from France, only a small number of countries such a USA, Japan and more recently Holland, have tried to develo mineral membranes for 'gas diffusion' in Uranium isotope en richment for nuclear uses and also liquid separation. In India there have been laboratory scale attempts to cast Alumin mineral membrane by the process of Anodic oxidation. Thes efforts are continuing with Atomic Research Laboratories a Kalppakam, Tamilnadu. Some of these commercially availabl porous inorganic membranes, viz, Membralox by Alcoa/SCT Anopore by Alcan / Anotec, PRD-86 by NGK Dupont, Ceraflo b Norton, Dynaceram by TDK, Strata-Pore by Fairey and Hytre by Osmosis (Hsieh, 1991).

Processing Technology

Membrane separation is a process of sieving of selectiv permeability of one or more components of a liquid mixtur through a membrane barrier. The one most common feature o all membrane filtration processes is that they produce separatio without any change in their phase. In Food Industry, membran processing has gained importance over the conventiona process for its several advantages, which are also useful t present the possibility for the production of newer intermediat dairy products, that can be used in different foods based on the functional properties. Since the commercial application o membrane process in dairy industry from 1960, it largely sprea out, particularly after the commercialization of high mechanica and physico-chemical resistant mineral membranes.

In dairy industry, there are four membrane processes now in vogue, namely reverse osmosis, ultrafiltration, microfiltration and nanofiltration. Another method being considered in this category is electrodialysis. The distinction between several membrane processes are somewhat arbitrary and has evolved with usage and time.

The separation characteristics of different membrane process are shown in Fig. A.



Reverse Osmosis

The word Osmosis is derived from the Greek word 'Osmos' which means push. To demonstrate the phenomenon of osmosis, a semi permeable membrane is required, through which the solvent will pass to the other side to dilute the solution i.e. an attempt is made to equalize the concentrations on both sides of the membrane. This is known as the osmotic pressure of the solution, which consists of the following facts:-

- Osmotic pressure is directly proportional to the concentration of the solute.
- Osmotic pressure is directly proportional to the temperature of the solution
- Osmotic pressure is directly proportional to the number of molecules or particles present.
- Osmotic pressure is directly proportional to more dissociation of ions or atoms with the electrolytes producing greater number of particles, which will lead to the corresponding higher osmotic pressure, i.e. osmotic pressure directly proportional to the dissociation of ions or production of greater number of particles.
- Osmotic pressure is inversely proportional to the molecular weight.

It means that the small molecular components make a greater contribution than the large ones. Hence in milk, the osmotic pressure is set up by the salts and lactose contents rather than by the proteins. In milk, the osmotic pressure is about 700 K Pa (7 bar or 100 psi) where 1 Pa = 1 NM^{-2}, and 100 K Pa = 1 Kg cm^2 = 1 bar = 14.3 psi. Therefore, reverse osmosis can be defined as a "process of flow of solvent from solvent side through a membrane to dilute the solution at other side and at the same time setting up pressure." If greater external pressure is applied on the concentrate side than the osmotic pressure, the process may be reversed, and the solvent will be pushed out of the concentrate back into the solvent side. This is the definition as well as the principle of reverse osmosis; which sometimes is also known as "Hyperfiltration" (HF), i.e. this process permits concentration based on the removal of water molecules only — Glover, 1985).

Reverse osmosis can be used for either purification or concentration. Production of pure water is an example of purification in which the contaminated water is recovered as permeate. For concentration, the components retained by the membrane constitutes the product and permeate, usually water, is discarded.

Concentration is the most difficult process but in R.O. concentration is done without involving any phase change or interphase mass transfer.

Characteristics of Reverse Osmosis

- In this process only water molecules pass through the membrane but other particles like ions, organic molecules over a molecular weight of about 100 daltons remain in the concentrate (Marshall, 1985, Pepper and Pain, 1987).
- Pore size is about 1-10°A.
- Operating Pressure is 1500 psi/g.
- Porosity is ~ 50%
- Membrane structure is asymmetric, thin film composite.

Advantages of Reverse Osmosis

- It is a continuous molecular separation process, in which the phase change or inter phase mass transfer do not take place.
- It requires very low energy for processing through membrane.
- There is always a recommended ambient temperature, being adopted, which causes no thermal oxidation or degradation of constituents (Patel ***et al.,*** 1987).
- It results in better nutritional and functional properties of milk constituents with improved product yield.
- There are minimum changes in pH and ionic strength of the feed being used.
- When milk is concentrated upto 2 folds using RO process the transportation cost of milk is saved by 25% (Mathur and Sachdeva, 2000).

Limitations of Reverse Osmosis

- Reverse osmosis is quite limited in their upper solids limits.
- In RO process, the osmotic pressure of concentrated solute limits the process of complete dryness i.e. no solutes are completely dry.
- The upper practical limit for the concentration of buffalo skim milk is 26% and for buffalo milk is 35% employing R.O. (Patel ***et al.,*** 1992).
- It causes fouling of membrane, cleaning of membrane and cleanability of some early molecules/modules etc., are the problems and limitations of reverse osmosis.

Ultra-filtration (UF)

Ultra filtration can be defined as "a pressure driven membrane process that can be used in the fractionation, purification and concentration of substances having a molecular weight between 10^3 to 10^6 daltons." It consists of a pump, which pumps the feed solution under pressure over the surface of a suitable supported membrane of an appropriate chemical nature and in optimum physical configuration. In the UF process, the pressure gradient across the membrane would force the solvent and smaller molecules through the pores of the membrane, while the larger molecules would be retained. The retained phase 'retentate or concentrate' as it is referred to, will thus be enriched in the retained macromolecules, while the permeate stream will be depleted of the macromolecules. The retentate will of course contain some of the permeate solutes also (Renner and El-Salam, 1991).

This process typically employs membranes with the molecular cut-off in the range of 10,000 to 75,000 D.

In the dairy industry, UF is frequently used in the separation and fractionation of individual milk proteins from lactose and minerals. Significantly, the permeate stream is 'sterile' due to the retention of microorganisms. UF is a superior method of fractionation than any other chromatographic techniques.

Characteristics of Ultrafiltration

- UF is a pure sieving process through a membrane, which has a definite pore size. The UF membrane retains only macromolecules or particles larger than 1-20 nanometers and allows the lactose and minerals to pass through, retaining larger molecules like protein and fat (Glover, 1985; Eckner and Zottola, 1992), having an operating pressure of 10-200 PSI.
- UF is not concerned with osmotic pressure like RO, therefore, working pressure for UF is low i.e. 500 KPa (5 bar).
- UF works on a principle of cross flow filtration since the feed flows parallel to the surface of the membrane, having a flow velocity of 5 MS^{-1} and its pore size exist between 5-35nm diameter

- Membranes in UF are made up of synthetic polymers (polysulphone), inorganic zirconium, oxide and alumina and its structure is asymmetric.
- In UF process, the concentration polarization increases, i.e. there is increase in the thickness of deposit layer, which results in a rapid decline in the permeate flux, because of gel layer on the membrane.
- Porosity is 60%

Advantages of Ultrafiltration

- In UF process, a portion of lactose and minerals are removed (Darghn and Savello, 1990), which is much helpful in production of low lactose milk product, specially cheese and other fermented milk products, which are very useful for lactose intolerant persons (Singh ***et al.,*** 1994).
- It has the best ability to retain the whey protein, while all the true proteins are rejected in the UF process (Green, 1990).
- Sterilized milk concentrates have also been developed from Ultrafiltered Skim Milk with a shelf life above 1 year (Muir ***et al.,*** 1984).
- UF retentate seems to be a highly promising base for long life paneer (Rao, 1991) and other products like good quality Chhana and Chakka (Singh ***et al.,*** 1994).
- A good quality rasogolla mix powder can be made by UF process (Pal ***et al.,*** 1993) in which milk is concentrated by 3 folds with all the milk proteins and reduced level of lactose and ash content.
- It increases the yield of cheese upto 10-30% due to the entrapment of whey protein and additional bound water.
- It reduces the energy requirement during heating and cooking steps.
- The requirement of enzyme is considerably reduced.
- The problems of whey disposal is substantially reduced, because of lesser whey production (Patel and Mistry, 1997).
- It is a more suitable process for manufacture of non dairy whitener (Mukherjee, 1996).

Limitations of Ultrafiltration

- UF membrane rejects all true proteins, while it retains the whey proteins only (Gupta, 2000).
- Neither RO nor UF can take the solute to complete dryness (Mathur, 2000).
- In UF process, because of high viscosity of retentate, pumping of retentate is more difficult. It has become an international issue on protein standardization of fluid milk and cream and its legalization. (Mathur, 1996).
- In UF process, the upper practical limit for the concentration of cow skim milk is 27% and for buffalo milk is 43% (Patel ***et al.,*** 1992).
- Fouling and cleaning of the membrane is one of the most important limitation of this process.
- Soluble salts like calcium, sodium and potassium are bound to go in the permeate, which are very important for giving milk its natural taste and also this is nutritionally required to maintain the level in retentate before spray drying (Patel ***et al.,*** 1991).
- UF needs many restricted operating conditions.
- The problem of concentration of polarization is one of the most considerable limiting factor, in which solids (solutes) begin to collect near the membrane surface, causing an increased resistance to solvent transport by invading the pores, resulting in a rapid decline in permeate flux, which changes the sieving nature of the membrane.

In addition to RO and UF, there are two other more distinct and descriptive terms characterising specific new applications of the membrane separation technology.

Microfiltration (MF)

It is "a pressure driven membrane separation process operating at transmembrane pressures (TP) of less than 1 bar, using porous membranes with cut-off pore size in the region of 0.05-10 cm (Bird, 1996), allowing passage of the proteins but retaining the macromaterials and suspended solids such as milk fat globules, micro-organisms, somatic cells and colloidal particles (Mathur and Sachdeva, 2000). It allows lactose and minerals too". Sometimes it is termed as "cross flow" or "tangential flow" microfiltration to signify that the fluid flow is tangential to the membrane surface and perpendicular to the permeate flow through the membrane so as to counteract the formation of deposit layer. It is also known as "loose UF".

Characteristics of Microfiltration

- It is a kind of Ultrafiltration, having pore sizes of 0.1-10 micrometer and called as "loose UF" or "cross flow" or "tangential flow" etc.
- It performs selective separation, because the design of the membrane is different from other particle filtration of suspended particles in the range of 0.05-10μm (Bird, 1996).
- It is essentially a clarifying operation to remove the suspended particles, including solids, milk fat globules, bacteria and colloidal particles (Merin and Daufin, 1990).
- Operating pressure works at 1-25 Psi.
- There is minimum changes in pH of feed, being used.
- Porosity is ~ 70%

Advantages of Microfiltration

- It is the best way to fractionate the casein and bio-peptides in pure form suitable for pharmaceutical industry.
- Very special interest is drawn towards the peptide derived β-casein, which exhibits morphine-mimicking (i.e. morphine like activity) have a greater effect on cardiovascular and immuno stimulating activities, antihypertension and antithrombosis.
- Many other attributes are remain unaltered viz. nutritional and therapeutic attributes of cheese and other fermented milk products.
- Milk can be separated into two major groups by this process i.e insoluble (casein and fat) and soluble (whey protein, lactose, ash, peptides and NPN) components.
- The most advantageous application of MF process is the selective separation of native casein micelles from the whey proteins (Sachdeva and Buchheim, 1997a), which possesses excellent rennet coagulating abilities and forms stronger gel at acidic pH (Famelort ***et al.,*** 1996).
- Bactocatch – it is a patentedsystem of producing pasteurized milk with an extended shelf-life by which 99.5% of all bacteria cells and 99% of spores in skim milk can be removed, (Larsen, 1996) without sacrificing the properties of coagulation (Samuelsson ***et al.,*** 1997). (Tetra Laval group). This is the combination of two processes (Unit operation) MF with UHT treatment. This process was originally developed to remove the spore forming bacteria from milk used in the manufacture of cheese, as high levels of spore formers (Clostridia etc.) can produce gas holes in cheese during ripening (Kerry and Tuohy, 1997).
- MF is also the most appropriate method to separate the low molecular weight peptides and free amino-acids from the protein substrates utilizing enzymes.
- It is best way to avoid fouling problem results in low energy costs by back chock technique (Guerra ***et al.,*** 1997).
- By the use of Membralox multichannel and Tetra Pak Filtration System employing 1.4μm membrane, microfiltration process is proved to be the most suitable debacteriasation of skim milk with very minor losses in solids not fat (Jost and Jelen, 1997).
- A potential product such as phospholipid rich can be obtained by the microfiltration of buttermilk whey (Sachdeva and Buchheim, 1997 b).
- The MF treated milk contains less than 4×10^5 somatic cell count/ml. Of fluid milk it is highly appreciable quality that leads to hygienic safety and more heat stable microfiltered milk, which causes a little difference in the whey protein content of permeate and retentate skim milk (Steele ***et al.,*** 1998).
- For the fractionation and recovery of whey constituents such as individual whey proteins, phospholipoproteins, dicalciumphosphate and lactose with the same heat stability (Steele ***et al.,*** 1998).
- MF-milk and pasteurized MF-milk possess the shelf life of more than a month, while it is only 4 days for raw milk and

14 days for pasteurized milk, at 4-6°C (Mathur and Sachdeva, 2000).

Nanofiltration (NF)

It is the process of separation by membranes of mineral ions in the 10^{-9}m size while retaining the organic molecules. This process is like RO and hence also known as Loose or Leaky Reverse osmosis (RO), Ultra-osmosis (UO) or intermediate of RO- UF. The membranes that are available industrially serve the useful purpose of selective rejection of ions based on their charges. The operating pressure employed is lower than the pressure used by RO. Due to the larger pore size of the membrane, it retains most of the lactose and is viewed as an ultratight UF as well as a loose RO.

Characteristics of Nanofiltration

- It is used for salt removal from whey. It allows monovalent ions and some divalent ions to pass, but retains organic molecules (Kelly ***et al.,*** 1991; Guu and Zall, 1992).
- Pore size varies from 10° A to 100° A.
- Operating pressure works at 300 Psi.
- Membrane structure is asymmetric and made up of thin film composite.
- NF can remove NaCl from the salty whey of chedder cheese (Gungerich and Hutson, 1996) with diafiltration in a batch process.
- Porosity is ~ 50%.

Advantages of Nanofiltration

- It separates minerals and ions to the tune of 10^{-9} m size
- In dairy industry main application of NF is for the separation of mineral ions from whey, dependent upon the pH of the whey to the tune of 38-40%.
- For the preparation of infant foods and many other dietetic foods (such as milk, cheese, butter, paneer, soy protein, fats etc.).
- Lactose intolerance is one of the global problem. By nanofiltration this problem can be reduced to a greater extent i.e. upto 4 x concentration to the level of 1000 to 2590 mg/litre.
- NF is an excellent alternative for the traditional method of concentration and demineralization of whey by evaporation and electrodialysis.
- NF is the lowest cost option for demineralization of whey if upto 32% ash removal is desired (Kelly and Kelly 1992).

Electrodialysis

It is also a separation process, in which membranes are used to remove ionic (electrically charged) from non-ionic particles through ion-selective membranes. These membranes are essentially ion exchange resin cast sheet form, which are classified as cation membrane i.e. it allows positively charged particles i.e. cations (Na^+, K^+) to pass through but when it allows negatively charged particles (Cl^-, Po_4^{3-}) known as anion membranes, which are altered with plastic spaces in a stock configuration with anode and cathode. On application of DC voltage across the electrodes, the electrical potential created causes anions to move in the direction of anode and cations towards cathode. The ion-selective membrane form barrier to ions of opposite charge, which results that anions, attempting to migrate to anode will pass through anion membranes and are stopped by cation membranes, while cations trying to migrate to cathode pass through cation membranes but are stopped by anion membranes. Hence, members from alternate compartments of ion-diluting cells and ion-concentrating cells for example, when whey is circulated through concentrating cells, free mineral ions leave the whey and collect in brine stream.

Characteristics of electrodialysis

- Electrodialysis is one of the best and most efficient demineralization process, widely used for whey demineralization.
- Electrodiaslysis membranes are thin sheets of cation or anion exchange resins reinforced with synthetic fibre such

as styrene-di-vinyl benzene resin.
- Membranes have an effective pore sizes of 0.7 – 2 nm.
- Membranes are impermeable to flow of liquids, solids and diffusion of larger molecules.
- Cation exchange membranes are of sulphonic acid group while anion exchange membranes are of quaternary ammonium or tertiary amine compounds as ion exchange sites for which Saran and Dynal are usual materials being used.
- Monovalant ions are more mobile than diavalant ions in this process.
- The characterizing properties of membranes are, electrical resistance, permeability selectivity, ionic capacity, solvent transfer and resistance to chemicals.
- The optimum demineralization by electrodialysis is obtained pH 4.65 (Sienkiewicz and Rieder, 1990).

Advantages of Electrodialysis

- It is mostly employed in dairy industry to demineralise whole whey and other milk derivative solutions.
- Electrodialysis does not remove the lactose from whey as it is done by ultrafiltration, which removes lactose and ash both, while we need full amount of lactose in whole whey infant formula.
- It is an economical process to remove ash from protein and lactose in a single step rather than two steps in other systems.
- It is the best alternative to ion exchange as a means of demineralising deproteinated whey.
- Electrodialysis products are often offered as a base for humanized milk which needs 90% demineralization.
- Only Europe utilizes 25,000 tones of electrodialysed whey solids annually in the production of demineralised calf milk replacer.
- Demineralised sweet whey (about 40-65% demineralised) is used in dietetic food as well as in foods such as coffee whitener, whey and citrus drinks, soft ice-cream, milk shakes salad dressing, animal feed, bakery goods, confectionary coating and dry mixes. Electrodialysis is useful to demineralise upto 35-50%.
- For the manufacture of dried whole sweet whey from the acid casein whey (Delaney, 1976).
- In USA, cottage cheese whey is demineralised to reduce effluent cost (Jensen and Oxlund, 1988).
- Reduced mineral whey is used as non-fat dry milk (Sienkiewicz and Rieder, 1990).
- It is used to increase the lactose yield in crystallization with combination of ultrafiltration.
- An electrodialysis plant can easily be made automatic and supplied with CIP system.

Disadvantages of Electrodialysis

- For efficient level of demineralization, it needs high current density and higher initial ash content which means electrodialysis needs a pre-concentration of whey either by RO or UF.
- Electrodialysis process needs a lot of water (2.5 m^3 of water/m^3 of whey 6% DM) which is continuously renewed.
- Electrodialysis causes a potential denaturation of proteins due to low pH in cation column and loss of protein in anion column.
- Membrane fouling because of deposition of calcium phosphate, is a very common problem which needs regular cleaning of cation selective membrane.
- At current density of 20-25 mA/cm^2, there is a danger of irreversible protein deposition which causes shorter life span of anionic membrane.
- Salt concentrations which are too low, cause an excessive electrical resistance in the whey and thereby increase the energy consumption of the process (Batchelder, 1987).
- Exhaustive demineralization by electrodialysis process is highly uneconomical (Singh and Mathur, 1990).

Conclusion

The potential capability of membrane processing which is a continuous molecular separation process without any change in phase and interphase mass transfer, has a profound effect dairy industry. Membrane technology offers to the processo low energy system compared to any other water removal proce such as evaporation, freeze concentration, freeze drying et without any complicated heat transfer or heat generati equipment to handle fluid milk stream as well as milk produc stream. The process can be used for the fractionation of protei biological peptides, protein rich milk, low lactose milk, skim m powder, soft and semi soft varieties of cheeses with improve product yield and consistency and more recently, it is bei utilized for the preparation of enzymatic derivatives of mi proteins having much pharmacological significance f example, manufacture of lactoferrin, used for infant formula health foods, skin creams and some antimicrobial produ causing minimal changes in micro-environment, (pH, ion strength etc.). It is also being used for the treatment of cance (i.e., Leukemia) (Broxmeyers, 1985). Membrane processin helps in alleviation of pollution and disposal problem of whe along with recovery of the nutritious whey solids (it reduces th BOD of whey to 500 mg O_2/litre by RO, 200 mg O_2/litre by UF fro an original value of 50,000 mg O_2/l.

It provides unique nutritional and functional characteristic (gelling, foaming and emulsification) and water holding capacit with reduction in microbial load to improve the quality paramete of dairy products such as flavour and extended shelf-life.

All these advantages have proven that the membrane tech nology is a better choice for many purposes in dairy and foo industry making it cost effective, efficient and rapid.

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Studies on the Shelf Life of Whey Based Mango Beverage

60, 70 and 80 days of storage respectively. So, from the result it is evident that the rate of decrease in sensory score was maximum in C_1 sample followed by C_2, P_1, P_2, S_1 and S_2. Krishnaiah ***et al.,*** (1989) prepared three categories of whey beverage, using deproteinized acid whey in first category, deproteinized acid whey and toned milk (3:1) in second category and lastly acid whey and toned milk (3:1) in third category and observed rapid change in sensory quality of beverages stored at room temp. without preservative than the beverages stored at refrigerated temp. with preservative or the beverages stored at room temp. with 0.05% sodium propionate and 0.01% potassium metabisulphite. The present result shows that irrespective of treatment imposed on the beverages, stored at 7 ± 1°C had a better shelflife than beverages stored at 30 ± 1°C. The aforesaid results also express that the sterilized products (S_1 & S_2) maintained their sensory quality in an acceptable condition for longer period than the product treated with preservative irrespective of temp. used for the storage.

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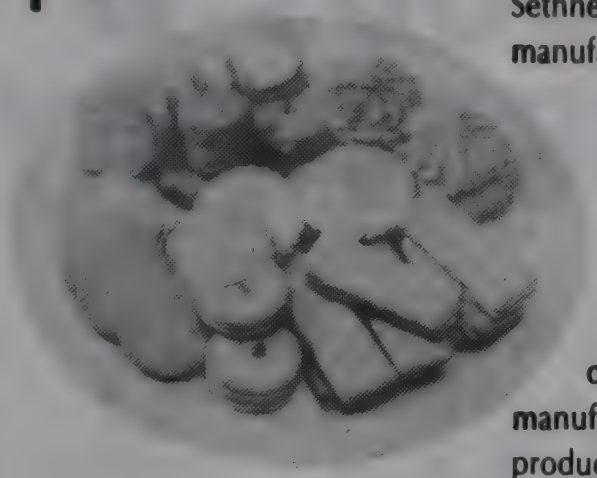

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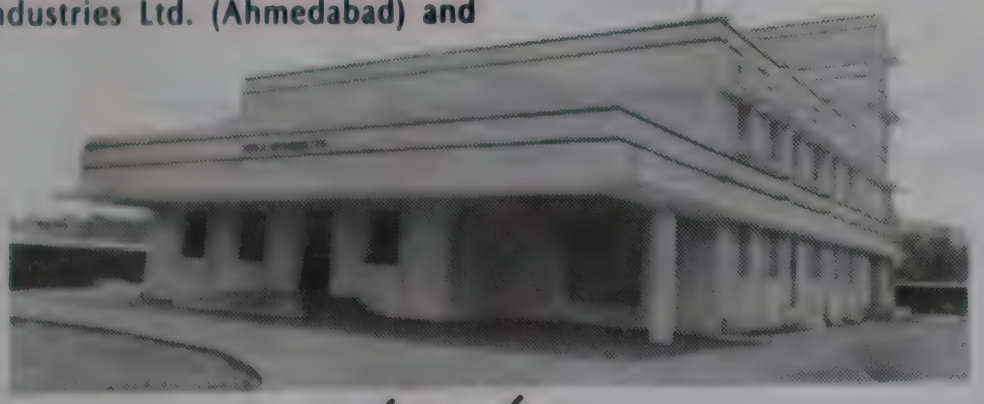

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COMPANY NEWS

PEPSICO

Pepsico recently acquired Gatorade, a sports drink which has helped it to scoop up a large market share in the health drink segment in US. Now PepsiCo is all set to launch Gatorade in India in the non-carbonated beverages sector.

Gatorade is a high-carbohydrate beverage which is positioned as a quick and sustained energy drink worldwide. The marketing of the drink has always been backed by sound expertise in sports nutrition and an understanding of the energy needs of athletes.

The acquisition of Quaker Oats by PepsiCo, has also helped the company to mop up large market share in the snack foods business. Quaker's $1.9 bn snack business – which includes granola bars, rice snacks and fruits and oatmeal bars is now part of Pepsi's product mix, courtesy the high-profile deal. If Pepsi decides to launch these products in India, it will extend Pepsi's reach into 'morning-on-the-go' foods, snacks for children and grain-based snacks.

The manufacturing systems of PepsiCo and Quaker Oats will help produce a range of products which also includes Lipton ready-to-drink iced tea, SoBe new age beverages which includes energy drink Adrenalin Rush, Dole juices and Season's Best fruit juices. Industry sources said that most of these brands will be introduced in India in phases.

FRUCOR BEVERAGES

New Zealand – based Frucor Beverages, manufactures 'V' energy drink which will soon enter the Indian market, exclusively marketed by Delhi-based MB International.

A Carbonated drink with Vitamin B and Guarana a herb for fat reduction, 'V' will be positioned as a nutrient supplement which improves mental alertness enhances concentration, provides a natural energy boost and rapidly replenishes energy levels.

However, the drink contains caffeine equivalent to a cup of coffee and will carry a warning label against consumption by children under the age of thirteen.

To be imported initially in 250 ml cans, 'V' would be priced at about Rs 60 which is a fair bit lower than the other energy drink 'Red Bull' which is currently available in the domestic market.

ARCOR GROUP OF ARGENTINA

Buenos Aires based Arcor Group of Argentina will be launching candies and chocolates in India shortly. The company will bring in 35 items of butter toffees, bakery products, bonbon chocolates, chewing gums and candies.

All the products would be imported and distributed through Delhi-based confectionery and bakery distributor, Surura Business, which also handles world's top brands such as Mars from the US and Kelsan of Denmark.

The company plans to achieve a sales target of Rs 35 crore over the next three years for Arcor confectionery products and expects to capture five percent of Rs 500 crore organised confectionery market over the same period.

HERITAGE FOODS

Heritage (India) Ltd., the Hyderabad-based milk and milk products company, is entering into agro-food products and milk based nutritional products marketing. The company is negotiating with US Foods and Pharmaceuticals a company which is promoted by Rajan Vembu a non resident Indian Doctor.

In the area of milk based nutritional products the company is planning to introduce nutritional formula foods with all proteins and supplements for new born babies, diabetic patients, lactating mothers and diet food.

Heritage Foods, at present, is marketing about 3.4 lakh litres of milk per day in the cities of Hyderabad, Bangalore, Chennai and Vishakapatnam.

The Company has got 10 milk procurement and processing centres and five packing stations apart from its main dairy plant at Chandragiri, near Tirupati.

UNITED BREWERIES

United Breweries has launched a new company UB International to manufacture and export processed foods and vegetables. It will cater to UB Global's export activities. UB Global is the trading and export arm of UB. UB International Trading will be a wholly owned subsidiary of UB, just as UB Global

Apart from the proposed exporting arm, Kingfisher.com has also became a wholly owned subsidiary of UB. The other subsidiaries include Associated Breweries, Managalore Breweries and United Breweries (Holdings).

Meanwhile, Mysore Wine Products and Nepal Liquors have ceased to be subsidiaries of UB, consequent to divestment of entire shares in them. Mysore Wine has been amalgamated with McDowell, while Nepal Liquor has become a subsidiary of McDowell. The business undertaking of Millennium Alcobev has also been sold to Inertia Industries with effect from March 31, '01.

COCA-COLA INDIA

Coca-Cola India is planing to enter into strategic alliances with south India-based companies for its Kinley brand of bottled water. Their focus will be in the 20-litre bulk pack segment which has seen tremendous growth.

A Coca-Cola executive said, Chennai accounts for 60 percent of the total water business in India. Also, the quality of water available there is hardly fit for drinking.

Bulk packs are the fastest growing category and to strengthen its presence in this segment, Coca-Cola acquired the water business of Thermax Culligan recently. The latter had so far been catering to corporates and institutional customers in the western part of the country with its Good Water bulk packs.

Coca-Cola India then moved to Delhi, where it took over the institutional business of Nuchem Weir, which manufactures the Kristal brand. In Kolkata, it has a tie-up with one of its franchisee bottlers for the 20 litre pack.

Together, the 20 litre packs corner 40 percent of the Rs 600 crore bottled water market.

SOUTH AFRICAN BREWERIES

The Rs. 22,000 crore South African Breweries has launched its mild beer, 'Three Lions' in the Indian market. The South African company known for breweries producing top beer brands – Castle Lager, Carling Black Label, Hansa Pilsner and Lion Lagar for hotels and resorts like Holiday Inn, Crown Plaza and Sun Internationals has a total market capitalisation of Rs 45,000 crore.

It is the fifth largest beer manufacturer with a 103 year heritage and produces 900 m cases of beer every year from 82 breweries in 82 countries having a 70 brand portfolio.

The company will shortly launch its other popular brand Castle Lager in the Indian market. The Indian beer market is growing at a rate of eight percent, while the Chinese market is growing at a rate of 15 percent.

The company had already started production from three units in India – Nawabgunj in Gonda (UP), Bangalore and Aurangabad with installed capacity of 1.5m, 2m and 4.5m cases per year respectively.

BDA

Officer's Choice Whisky a single offering from Kishore Chhabria's BDA, the wonder brand will now be extended to other spirits. The brand that sells over 3.5m cases a year, and it will now be used to launch products in the rum and brandy segments. All the new offerings will carry the 'Officer's Choice' brand name. BDA has already launched Officer's Choice No. 1 Brandy in Hyderabad, at Rs 225 for a 730 ml bottle.

BDA has also slated a national launch of Officer's Choice Rum soon.

BDA plans to upgrade its brand value, which is currently confined to the regular segment. It plans to launch a premium whisky which will compete with the likes of Shaw Wallace's Royal Challenge and McDowell Premium.

MARICO INDUSTRIES

Marico Industries, as part of the company's initiatives to strengthen its brands portfolio, has extended its SIL brand across various processed food categories.

The SIL brand, which was present only in jams, has been extended to sauces, soups and mayonnaise.

In sauces, the company has sidestepped the largest market segment – tomato sauce – and has opted to cater to niche sectors such as chilli (red and green) and tamarind sauces.

SIL has a 15 percent market share in the Rs 50-60 crore jam segment where the total volume is 600-700 tonne per month. Hindustan Lever Ltd's (HLL) Kissan leads in the category and commands a market share of over 60 percent. Currently, SIL contributes around 3 percent to Marico's Rs 670 crore turnover and expects to exceed this mark in the current fiscal.

Marico has a marketing and distribution tie-up with Indo-Nissan for selling the latter's Top Ramen noodles brand. Top Ramen has around 18 percent market share in this segment.

CADBURY SCHWEPPES

UK Sweets and soft drinks major Cadbury Schweppes has recently bought over the soft drinks business of France's Pernod Ricard, for the Orangina, Pampryl, Champomy and Yoo-Hoo brands in continental Europe, North Ameica and Australia.

Cadbury is ranked third in global soft drinks behind Coke and PepsiCo.

Orangina's dimpled round bottle is a household icon in France and the nation's second-best selling brand after Coke. It will join Cadbury's Oasis, Canada Dry and Dr Pepper brands and will double Cadbury's share of the French soft drinks market to almost 19 percent, making it number two after Coke.

SANAMEX INDIA

Swiss Company Sanamex S.A. through it Indian arm Sanamex India will bring in the country, South American wines ranging from Rs 365 to Rs 22000.

The wines are from Argentina, Chile, Portugal and Hungary. Argentina's premium wine brand, Trapiche, known as the "star in the Southern Sky," is among the range of products for the Indian market. The Trapiche collection has an array of wine labels including, Cabernet Sauvignon, Chardonnay Astica, Merlot, Pinot Noir, and Syrah.

The Sanamex collection includes the champagnes, Bollinger and Salon. The Bordeaux wines include Jolamotte at Rs 500 and Chateau Margaux, at Rs 22,000. Italian wine Villa Lucca, to be priced at Rs 525, is Sanamex's inhouse production. Fresco Baldi from the Tuscanay region will be priced at Rs 5,500. Colombe red wine, again a Sanamex product, will cost Rs 365.

Port wines from Portugal, especially Quinta do Novel, in the Douro valley in North Portugal, also will be in the market soon. They include, Novel Fine Ruby Port and Tawany Port. A range of Chilean wines, especially Piduco from Maulle valley, which created a sensation in the world wine market, in the '80s will also hit the Indian market soon. The firm claims the wines it distributes throughout the world is from a single source that ensures uniform quality.

SHAW WALLACE & COMPANY

Manohar (Manu) Rajaram Chhabria is ready to offload equity in Shaw Wallace & Company (SWC) to a strategic partner. Chhabria is also taking Shaw Wallace global – marketing offices are to be opened in Europe. Two beer brands are being exported to the UK and he is trying to buy a distillery in Scotland. The Dubai-based non-resident Indian businessman explained that he was splitting SWC into three companies – the Rs 1,540 crore SWC itself would be the holding company, while the beer and distillery business would be separate companies – because this would provide an opportunity to unload an as-yet-undetermined percentage of the equity to a strategic partner.

SWC is in the process of setting up four more breweries (in Kerala, Karnataka, Madhya Pradesh and West Bengal) at a cost of Rs 100 crore (the promoter contribution will be 50 percent in most of these cases) and the current 22 million case capacity is being doubled.

Shaw Wallace in India is embarking upon a complete makeover of its labels, bottles and cartons. Claessens of the UK, the world's biggest label producer will be designing them. Shaw Wallace already sells Lal Toofan beer in the UK but has started shipping Kohinoor there. These products have been accepted by the Food and Drug Administration.

COCA-COLA / PROCTER & GAMBLE

Consumer products giant Procter & Gamble and No. 1 soft drink manufacturer Coca-Cola said recently that they have scuttled plans to form a joint venture to sell and develop snacks and juice drinks.

The announcement comes eight months after the companies unveiled with

great fanfare a venture that would have combined Cincinnati-based P&G's Pringles potato chips and Sunny Delight juice drinks with Atlanta-based Coca-Cola's Minute Maid juices and Hi-C, Five-Alive and Fruitopia drinks.

Coca-Cola will now consider other options, which could include acquisitions or developing drinks internally, spokesman Rob Baskin said.

FROMAGERIES BEL

French Cheese giant Fromageries Bel entered the Indian market in March when it brought *"Laughing Cow"* brand cheese into the country. It now intends to widen its portfolio by bringing Kiri (creamy cheese in cube form) and Babybel (semi-hard with a wax coating appropriate for sandwiches) into the market. The Indian consumers will get to taste new flavours such as ham, tomato, green peppercorn and mushroom.

Somesh Dayal head, Fromageries Bel India says "we do plan to bring in more brands into the markets but only when we have consolidated our position with Laughing Cow as the other brands will just be add-ons and may not generate volumes".

The company has recently introduced Laughing Cow in the Bangalore market after a successful launch in Mumbai, Delhi, Gujarat, Punjab and Rajasthan. Dayal claims that the companies had big plans to push the brand through promotion.

The Rs. 300 crore cheese market in India is dominated by players like Amul, which is said to enjoy a clear leadership with 50 percent share of the market followed by Britannia with nearly 35 percent share. But with players such as Nestle and Kraft expected to make a foray into the Indian market, the competition will increase and marketshare ratios likely to change.

The company, which sells Laughing Cow cheddar cheese in two forms – the triangular portions and singles – is targeting a 20 percent marketshare of the cheese cube and spread market.

BRITANNIA INDUSTRIES

Britannia the market leader in the biscuit and bakery products segment in the organised market recently acquired Kwality Biscuits for Rs 30 crore including the 'Kwality' and 'Chef' symbols, and several other trademarks. It has set aside Rs 50 crore for funding new projects and acquisitions. The company has issued 50 lakh secured redeemable non-convertible privately placed debentures of Rs 100 each amounting to Rs 50 crore at 10.9 percent interest per annum for funding new projects and acquisitions. Britannia has already announced that it will fund its in-principle agreement to acquire 49 percent of Kwality Biscuits through internal accruals.

Britannia is also assessing the future plans of Kwality as a brand and intends to keep Kwality Biscuits as a separate company and there are no plans to merge the existing capacities of both Britannia and Kwality. It said Britannia Industries will continue to focus on improving its sales and profits through new product launches and innovation.

TASTY BITE EATABLES

Tasty Bite Eatables Ltd. has added a range of six new South Indian delicacies to its already existing ready-to-eat North Indian Foods and curry sauces. The new range includes popular dishes like Bisi bele bhath, Pongal, Khara bhath.

The company claims that the products are natural with no added preservatives. They can be stored without refrigeration for 18 months. The new products will soon be available in major super markets across the country.

DABUR FOODS LTD.

Dabur Foods Limited has recently introduced a new variant to its 'Real' juice kitty called Real Activ. It comes in two variants, orange and apple. According to the company it is 100 percent juice with no sugar, colour, preservatives and no additives. The company is targeting the health conscious consumer, who prefers to consume natural fruit juice.

Real Activ is currently available in one litre packs priced at Rs 62. It has an attractive packaging with an international spin cap with fruit visuals.

Dabur already has its 'Real' range of fruit juices in mango, pineapple orange, tomato guava, grapes and mixed fruit flavours. The company claims that it enjoys a marketshare of 55 percent.

UNITED DUTCH BREWERY

Oranjeboom, the beer from the United Dutch Brewery Netherlands, a 100 percent subsidiary of the Belgium-based beer major, Interbrew will now be available in India. The can of beer, to be priced at Rs 99 for 330 ml, will be competing in the Indian market with premium imported brands Heineken (Rs 134) and Corona (Rs 145). The beer is now consumed in over 60 countries.

With an alcohol content of five percent, the beer is mildly bitter. The manufacturers of the beer claim the water used in making Oranjeboom is drawn from 100 metros deep well of crystal clear water. The brewery started production 450 years ago, when the founders discovered this well.

GODRAJ AGROVET

The integrated poultry division of Godrej Agrovet is setting up a 8000 tonne processing plant at Taloja in Maharashtra in technical collaboration with The Netherlands headquartered Stork group of companies at a cost of Rs nine crore, said BS Yadhav, general manager, integrated poultry division of Godrej Agrovet.

The proposed unit will improve its market share in the western region particularly in Mumbai, Nashik and Pune. The company recently launched its 'Real Good Chicken' in western region.

Its other processing unit (4,000 tonne capacity) situated at Bangalore caters to the southern market. As part of its expansion strategy, the company is planning to take its Real Good Chicken brand national. The company has plans to start similar projects at a national level but no timeframe has been fixed as yet.

The company claims that its chicken has a shelf life of 72 hours. It has a market share of about 4 percent in the total poultry market, while Venky's has a market share of about 20 percent.

The poultry division contributed around Rs 100 crore to Godrej Agrovet turnover of Rs 700 crore in 2000-01.

AMUL

Gujarat Co-operative Milk Marketing Federation (GCMMF), the owner of the Amul brand, is planning to set up four pizza factories in the four regions of the country with an aim to sell at least 300,000 pizzas a day within a year from now.

"The pizzas will be sold under the 'Utterly Delicious' brand name," said B M Vyas, GCMMF managing director.

The dairy cooperative is also expected to launch chocolate flavoured milk under the 'Amul' brand name to take on the existing players like Britannia Industries which sells the product under the Milkman brand. Amul flavoured milk will be made available in 100 ml and 200 ml sizes of hard paper packs (popularly known as tetra-packs), GCMMF managing director B M Vyas said.

A pizza factory adjacent to its ice-cream manufacturing unit at Gandhinagar, Gujarat, is already ready.

GCMMF proposes to make and sell pizzas in frozen through the retail network across the country. The logistic costs involved is minimal since Amul is already using a cold chain to transport Amul butter, cheese and a host of other milk products – to some extent ice-creams – within the country.

MTR

Bangalore-based MTR Group is launching a range of frozen foods which would cut down cutting, chopping and frying time. The range would have both south and north Indian delicacies like rice idli, masala dosa, capsicum masala, aloo

paratha etc. This apart, it is also readying its plans to launch soluble coffee. With all this, the 62 crore company is eyeing a turnover of Rs 100 crore.

The products will be reasonably priced, claims the company, with a dosa costing Rs 8, two rice idli Rs 5 and rava idli Rs 8.

The company already has a ready to eat range and its immediate plan is to consolidate its distribution network in the existing markets so that its products can reach to both rural and urban households in the country.

Though MTR is a strong brand in the southern markets, it is almost non-existent in the north. The company would also be focusing on major brand building initiatives.

NESTLE

After milk, dahi and butter, Nestle India is eyeing the emerging market of fruit-based milk drinks in the country. Alongside, the company is also conducting an extensive market research tacitly called 'Operation Som Ras' to study the untapped chilled dairy drinks segment and its possible business potential. "Nestle is a worldwide leader in chilled dairy and in India we are looking at this category from a long-term perspective," the Nestle spokesperson said and added "if consumer preference indicates a potential market, then fruit-based milk drinks could be a part of our portfolio in the future." One of the first products being given a close look is a mango-based milk drink packaged in tetrapaks under the operational name of Nestle Natural Fruit-in-Milk. The company is also believed to be looking at other flavours such as banana, strawberry and mango.

Nestle recently entered new – low margin high volume – business like dahi, UHT milk, bottled water and most recently table butter. The company has also signed a strategic alliance with Nilgiris in the south for manufacture of all 'chilled' dairy items.

MILK FED

After emerging as a producer of one of India's best selling quality milk and milk products, the Punjab Milkfed has now set its eyes on the world market. It has begun negotiations with two foreign multinationals to produce a variety of processed cheese items for them and market them in India and abroad under their world famous brand names. The company is confident that the Milkfed plants would be able to meet the high standards and stringent quality control required to penetrate the world market. Milkfed has also received a number of trade enquiries from Saudi Arabia, Qatar, Egypt, Russia and China.

AJITH DAIRY

Ajith Dairy Industries Ltd. (ADIL), which was acquired by the Chennai-based Hatsun Agro Product Limited last year, is now proposed to be merged with the latter. In October, 2000 Hatsun Agro picked up 81 percent stake in ADIL. Consequently, ADIL became a subsidiary of Hatsun Agro.

Hatsun Agro recorded a turnover of Rs. 149 crore as against a turnover of Rs. 97 crore during the previous year. The performance of its dairy division has been continuously encouraging and for the year 2000-01 it grew by 61 percent by contributing Rs. 111 crore to the topline. On the other hand, ADIL achieved a turnover of Rs.36.17 crore as compared to the previous year's turnover of Rs. 39.28 crore, thereby registering a decline of eight percent.

MILMA

The Kerala Cooperative Milk Marketing Federation Ltd. (Milma) has been permitted by the National Dairy Development Board (NDDB) to use the latter's logo on its milk sachets. Mr. P.T Gopalakrishna Kurup, Chairman, Milma said that this was a quality certification from NDDB, which would enable Milma to sell its milk throughout the country. Mr Kurup said NDDB had embarked on a campaign to give a uniform identify for milk sold across the country through the cooperatives. For the purpose, NDDB had worked out strict quality guidelines which a participating brand must conform to before it qualified for the campaign. These guidelines related to improving the quality at various levels – quality of raw milk, bacteriological count, cold store conditions and retailing standards. Milma is the first federation in the country, which has been permitted by NDDB to use its symbol, Mr. Kurup said.

ADANI WILMAR LTD.

Adani Wilmar Ltd. India's second largest edible oil importer, plans to boost edible oil purchases by 64 percent to 700,000 tonne in 2001-02.

Adani Wilmar imported some 350,000 tonne of edible oil, mostly crude soyoil and palm oil, between April and September. The big jump in imports was mainly because of the success of its packaged edible oil brand "Fortune", launched in the Indian market last year. India bought 4.15 million tonne of oil between November and August, up from 3.47 million tonne during the same period last year.

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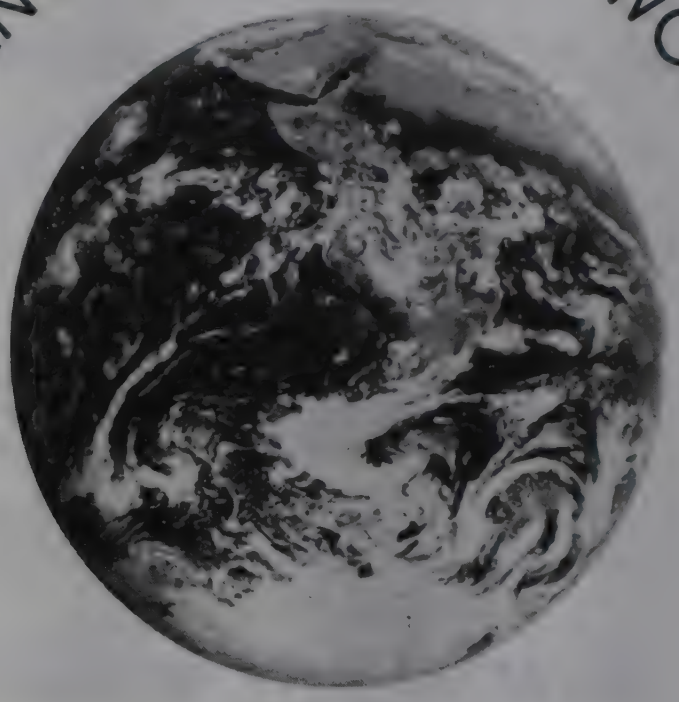

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INDIAN NEWS & NOTES

IMPORTED SPIRITS TO PAY REGISTRATION FEE

The Maharashtra government has issued a notification effective from August 31, 2001; stipulating that labels and brands of imported spirits and wine should be registered in Maharashtra.

The decision is expected to badly affect the imported wine and spirit business, which is already struggling under a high import duty regime. The state has imposed a fee for registering brands and labels of imported wines and spirits in Maharashtra. For registration of labels, the fees are – Rs 15,000 for spirits, Rs 10,000 for wines and Rs 7,000 for beer.

The registration fees for brands is: Rs 10,000 for spirits. Rs 7,500 for wine and Rs 5,000 for beer. All this is in addition to a 210 percent basic customs tariff, an additional duty ranging from 75 percent to 150 percent.

CONSULTANTS ROPED IN TO BOOST INDIAN TEA EXPORTS

Facing stiff competition from other Asian and African countries in the International Tea Market, the Indian Tea Board has taken the services of "Accenture", a leading consultancy firm, to lay out a medium term strategy to boost sagging tea exports. It has also appointed another consultant A.F. Ferguson to review the functioning of tea auctioning systems.

The country's tea exports have fallen in June by 21 percent to 14.36 million kg from 18.17 million kg in the corresponding period last year. The country's total tea exports during the first half of the current year till June stood at 79.62 million kg against 84.18 million kg last year, showing a decline of 5.88 percent.

India's share in the world tea crop was about 30 percent at about 2.9 billion kg in 2000, but its shares in world export was only about 15 percent, a Status Paper prepared by ITA recently said.

HIMACHAL TO CULTIVATE BIO-TEA

The tea grown in Himachal Pradesh is known as Kangra tea, considered second only to Darjeeling tea in the country, and its cultivation dates as far back as 1845 when it was first planted in the Palampur foothills.

Kangra tea was exported to London, Barcelona and Amsterdam in the 1850s, and Afghanistan, Ladakh and Tibet were its competitors.

However, much of the flourishing tea industry in the state was destroyed in the massive Kangra earthquake in 1905. Efforts to revive the industry have been made only in the last two decades.

Kangra tea is quite similar to the tea growth in China and Taiwan. It is marketed in Kolkata. The four varieties of this tea are named after the Kangra miniature paintings: Bahar, Malhar, Darbasi and Bageshwari.

Now Himachal Pradesh has drawn up an ambitious Rs 1.3 billion plan to cultivate bio-tea in the districts of Kangra, Chamba and Mandi in a bid to grab a share of the high-end market.

The state hopes to find a ready market for its organically grown tea among the connoisseurs "Pesticides, insecticides and chemical fertilisers will not be used in the cultivation of bio-tea", a spokesman of the agriculture department said.

The salient feature of the state's latest tea policy is "the use of advanced technology in the production of tea, investment by private and corporate institutions." At present, tea production in the state is confined to small and marginal farmers.

BIS LABEL FOR 229 MINERAL WATER FIRMS

All the major players in the packaged water industry including Ramesh Chauhan's Bisleri, Coca-Cola's Kinley, Pepsi's Aquafina, Nestle's Pure Life and Prakash Chauhan's Bailley have procured the mandatory quality ISI mark imposed by Bureau of Indian Standards (BIS), for packaged water.

According to the latest data, 229 franchisees of all the major packaged water companies all over the country have obtained the BIS certification.

However, in the natural mineral water category, only three brands – Himalyan, Catch and Life Spring – have obtained the mandatory ISI certification.

About 14 manufacturing facilities of Coca-Cola, 15 of Bisleri and 5 of Pepsi have obtained the ISI certification. BIS has recently reduced the testing fee from Rs 1.49 lakh to Rs 96,000 for the large manufacturers, while small manufacturers will continue to be charged Rs 84,000.

DR. KURIEN TO BE HONOURED WITH ROCHDALE PIONEERS PRIZE

Dr. Verghese Kurien is to be the first recipient of the Rochdale Pioneers Prize instituted by the International Cooperative Alliance (ICA). The award will be presented at the ICA General Assembly Meet to be held on October 17, 2001 in Seoul, Korea. The ICA recently established the Rochdale Pioneers Prize to recognise a person, or in special circumstances, a cooperative society, who

has contributed to innovative and financially sustainable cooperative activities that have significantly benefited their membership. The prize is to be awarded every two years in conjunction with the ICA General Assembly. Dr. Kurien is the founder Chairman of the National Dairy Development Board. He is presently the Chairman, Gujarat Cooperative Milk Marketing Federation and Chairman, Institute of Rural Management, Anand. IDA extends its coagratulation to Dr. Kurien for the honour !

BLUEPRINT FOR BASMATI PATENT'S COURSE

There is still tremendous scope to concretise India's rightful claim on Basmati in the three categories of patents, trademarks and geographical indications by taking a proper legal recourse including its attestation under the Lanham Act in the US, according to patent and trademark attorney with the corporate law group, Ms Krishna Sarma.

Ms Sarma said that though the US has no separate legislation for protecting geographical indication under Section 4 and 45 of the Lanham Act certification marks were used to attest food which comes from the region named.

Citing an example, she said tea bearing the name Darjeeling was protected as a certification mark and must find its origin from that region or risk trademark infringement. Basmati producers could take this cheap step for protection.

Simultaneously the government should give protection under Geographical Indications of Goods Act, 1999 which though restricted to India's territory gave the country the legitimacy to demand reciprocal protection in other jurisdictions.

PACKAGING SECTOR HIT BY DUTIES

The Rs. 5000 crore flexible packaging industry is facing a raw materials crisis after the imposition of provisional anti-dumping duties on the imports of BOPP, the critical raw material. This was stated by MK Srinivasan, honorary president, Paper, Film and Foil Converters' Association (PFFCA) recently. The association is taking legal opinion to counter the anti-dumping measures and will initiate action shortly, he added.

The PFFCA fears that with the imposition of anti-dumping duties on BOPP – the main ingredient for print substrates used in flexible packaging – domestic suppliers of BOPP will jack up prices, making it unviable for flexible packaging producers to continue with their operations.

Earlier, PET film manufacturers petitioned the director-general, anti-dumping (DGAD) to impose an anti-dumping duty on PET film on the ground that the export price was significantly below the normal price in the exporters' countries and the share of imports and the quantum of imports from these countries had gone up significantly and the profitability of domestic manufacturers had got eroded.

This proposition was accepted and DGAD imposed the duty on the import of PET film into India in May 2001. However, the PFFCA claims that the petitioners misrepresented their case. No sooner was the anti-dumping duty imposed than leading manufacturers of PET film formed a cartel and raised domestic prices by 45 percent, it says.

The impact of this increase in PET film price has been felt by flexible packaging manufacturers since June 2001. PFFCA fears a recurrence of this in the case of BOPP. The print substrates used in flexible packaging largely consist of BOPP film, polyester (PET) film and PVC. Of these, BOPP film and PET film constitute 95 percent of the overall print substrates. The cost impact of PET film and BOPP film on the overall packaging cost ranges from 35-85 percent, depending on the product to be packaged. For essential commodities, the impact on cost is as high as 85 percent.

Flexible packaging largely includes packaging of products of essential day-to-day commodities like salt, tea, soap, detergents, biscuits, rice, pulses, spices, flour and ready-to-eat foods. It also covers packaging of premium high-end products like cosmetics, soft drinks, shampoos and lubricants.

The flexible packaging industry consists of players in both orgaised and unorganised sectors.

US ATTACK LEAVES SHRIMP EXPORTERS HIGH AND DRY

Already reeling under the impact of a slowing Japanese economy (which accounts for almost 65 percent of shrimp exports) the aquaculture industry could find itself in dire straits following the US attacks.

Concerned buyers from Japan have started cutting price by up to $1 per kg after the incident. US enquiries – the next major market for Indian shrimp – have almost dried up while the few enquiries in hand are quoting between 50 to 60 cents lower.

What has complicated matters for many packer-exporters is that they were holding on to stocks in anticipation of a price increase following lowered sea catches.

AMERICAN SOYABEAN ASSOCIATION TO POPULARISE SOYA IN INDIA

The US is focusing on India for selling its soya isolates and products in the future. Isolates are the highly processed forms of soyabean with upto 90 percent protein compared to 40 percent in soya flour and could be used in a wide range of products.

"US strategy is to first create demand for soya products by spreading awareness and giving technical assistance a then cater to it," said Gil Griffs, Asia di sion director of American Soyabean A sociation (ASA).

As demand for soya products whi had large applications in dairy, poult and human consumption increased India, its own soyameal would not b enough to meet the demand and the U would then be pitching in.

American Soyabean Association a organisation of 35,000 US Soyabea farmers, which provides technical assis ance to food industry worldwide for bett utilisation of protein rich soyabean, ha launched a drive for greater use soyabean in traditional Indian cuisine.

Soyabean consumption in India ha remained stagnant. However, many com panies are again showing interest now Other food processing houses are bring ing out poustic atta (flour mixed wit soyabean atta). Mother Dairy is also tes launching dal analogue, a soya produc in Gujarat.

This will increase the food value sig nificantly as soyabean is the highes known reservoir of vegetable protein. I 1999, United States Food and Drug Ad ministration (USFDA) said that 20 grams of soya protein can reduce chances o heart ailments by decreasing cholestero levels in blood.

Madhya Pradesh is the biggest pro ducer of soyabean in India while US tops the world list in soyabean production.

REGISTRATION MANDATORY IN INDIA FOR LARGE DAIRY PLANTS

The Indian government has made i mandatory for large dairy plants to regis ter themselves. Any breach of regula tions may lead to cancellation of registra tion. Dairy companies will have to display their registration number prominently on polypacks and containers. They will also have to label the product composition and content, the complete address of the place where the product has been manu factured or packed, and the names and registration numbers of the manufacturer and the organization marketing the prod uct. This rule applies to all dairy plants handling over 10,000 l/d of milk or more than 500 t/y of milk solids.

BRAND PROTECTION SOUGHT FOR FENI

Goa's famous feni is now finding fa vour with the connoisseurs of the drink abroad. An international demand is slowly emerging for feni, popularised by the tour ists who return from Goa with a couple of bottles. Madame Rosa distillery, a lead ing manufacturer of branded feni in Goa has already exported a thousand cases to London and Dubai this year. And more exports are in the offing for its range of products. And now, feni connoisseurs in Goa think there is an urgent need for

international registration of feni on the basis of geographical indication, in line with Champagne and Scotch whisky. Champagne and scotch whiskies are registered, under the terms of Lisbon agreement of World Intellectual Property Rights Organisation (WIPO). No manufacturer can classify his product under the title Champagne, unless produced in Champagne district of Southern France, however good the quality of wine is. Ditto Scotch whiskies, which has to be produced in Scotland. Feni manufacturers in Goa are seeking a similar brand protection – an international recognition to the effect that unless produced in Goa, it is not feni.

LACTOBACILLUS STRAINS FOR PROBIOTIC APPLICATIONS

Researchers at the National Dairy Research Institute, India, have tested some promising isolates of lactobacilli exhibiting antimicrobial properties against *E. coli, Bacillus cereus, Staphylococcus aureus, Enterococcus faecalis* and some other lactobacilli. These isolates exhibit probiotic properties necessary for adhesion and colonization in the intestine. All the cultures survive well at pH 2.0 for three hours. One of the isolates showed the best growth pattern after 12 h at 4 percent bile concentration, but others could survive only up to 15 percent bile concentration or less. Cell surface hydrophobicity ranged between 0.4 and 81.9 percent.

Two isolates were selected for protoplast fusion. One of them showed the highest cell surface hydrophobicity of 81.54 percent and was resistant to kanamycin. The other survived best at 4 percent bile level for 12 h and was resistant to streptomycin. These two antibiotics were used as markers for selecting fusants. Following protoplast fusion and regeneration, 28 fusants were obtained out of which five fusants showed hydrophobicity ranging from 34 to 48 percent. All the five selected fusants could survive well for 3 h at two percent and 12 h at four percent bile level. They also indicated strong inhibition activity against the indicator organisms used. These isolates as well as fusants can be used for the production of potential probiotic fermented foods.

DEFENCE FOOD LABORATORY

Food Preservation Technology Mysore based Defence Food Research Laboratory developed food preservation technology has proved to be a great success, with over 30 entrepreneurs want access to DFRL technology with th transformation of urban lifestyle, the ready-to-eat food segment is growing rapidly.

The institute has successfully designed operational pack (ready-to-eat) rations for the armed forces to meet their operational needs comestibles.

Transportation and storage of perishable products, like fresh fruits and vegetables to troops deployed in far-flung areas was a major problem. "The institute has successfully developed packaging and preservation technology which enables transportation and storage of fruits and vegetables for periods ranging from 5 to 20 days," the official said.

According to him, the institute has also successfully developed packaging and storage technologies for sugar and milled products for humid regions. Stack encapsulation technology enables safe storage of commodities for more than a year.

The institute has also developed rapid methods for detection of pathogenic bacteria e-coli and salmonella in milk and milk products, identification of total microbial contaminant in meat and spoilage levels in milk powder, oils and flour. The tests are simple and can be performed at depots having no laboratory facilities.

According to the official, the institute has also developed technology to pack tender coconut water in aluminium cans and pouches. This project is sponsored by the Coconut Development Board (CDB).

FRESH CUT PROCESSED FOOD

Fresh cut processed food industry is big business in the West. Take for example, the multimillion dollar American MNC Coronet Foods which specialises in cut vegetables. Its operations span across continents from USA to China where it sources and processes all kinds of vegetables from the common onion and potatoes to exotic broccoli to baby corn. There are several such big players in the West who have streamlined the technology and reaped rich profits.

The success story can be repeated in India as well according to Chetan Hanchste, senior manager at Centre for Processed Foods (CPF), an NGO adjunct of the Centre for Technology Development which has identified food processing as one of the important thrust areas for active promotion. "By processing vegetables before they come to the market we not only preserve quality and cut down handling losses but also reduce the influx of garbage into cities".

As per the FAIDA (Food and Agricultural Integrated Development Action) report released by McKinsey, in India the price of produce triples between the grower and the consumer because there are several intermediaries. "By locating the processing centres near producing farms, we can give a good price for the farmer and also cut down on the intermediaries thus giving a fair price to the consumer as well," says Mr. Hanchate. "There are significant growth opportunities for

big companies to tap this market.

Apart from retail customers, they can supply multinational restaurant chains and the hotel industry," he adds.

The difference between cut and frozen vegetables is that the former is freshly harvested and needs to be consumed within 10 days. Instead of vegetables coming directly from the farm to the store, it goes to a processing area where it is washed with potable water then treated with recommended surface disinfectants and then it is taken for peeling and cutting as per the requirement.

The vegetables are ready to cook as only the edible portion is transferred to the market. Cold storage is crucial to this business. The cut vegetables tend to deteriorate rapidly and lose nutrients. If they are kept at five degree centirade or less preserved and best results can be obtained. Vegetables such as carrot, beans, cauliflower *et al* can be preserved up to ten days. Some leafy vegetables like lettuce, spinach, *et al* can also be preserved by proper packaging.

The treatments and technology for preserving cut vegetables have been developed by Central Food Technological Research Institute (CFTRI), CPF can source technology and get HACCP and ISO clearances for the projects as well. There are different kinds of packaging such as ventilated pouches, special laminates which respire which are required. Test marketing of these products has already been done in Mysore and has been found to very successful.

THE NUTRITIONAL VALUES OF CHEESE

Cheese has a high nutritional value and is a good source of protein, calcium, phosphorous, zinc, vitamin A, vitamin B_2 (riboflavin) and vitamin B_{12}. There are significant numbers of children who become deficient in a variety of micronutrients, primarily because of their dislike of the taste of many vegetables. Cheese is a food that most people, including children, like to eat. Hence, the consumption of natural cheese or some of the recently released nutritionally enhanced cheese may be a way to overcome such deficiencies.

STATE CUTS EXCISE ON WINE MANUFACTURING

The Maharashtra Cabinet announced a grapes processing industrial policy aimed at providing an impetus to grape-based wine making in the state. This includes reducing excise duty on existing wine manufacturers by 50 percent and by 75 percent for new units being set up.

Maharashtra is one of the largest producers and exporters of grapes. Of this, while much is of the table top variety, three to five percent of grapes produced is suitable for wine production. There is a need to rationalise the tax regime that governs this industry.

One of the prime reasons for the low consumption of wine in India was the high retail prices of wines in the country that was a direct result of the high tax regime imposed upon wine manufacturing.

The industrial policy that was announced is aimed at facilitating loans to the agro-food processing industries and including wine manufacturing in the same so that wine manufacturers can also avail of loans from NABARD. Similarly a levy of Rs 5000 would be placed for the sale of wine products which would remain constant for the next decade. A single window window system would be put in place to facilitate the issuance of clearances and requisite licenses to wine manufacturers.

DISCREPANCIES IN IMPORTED DAIRY ITEMS

The National Dairy Development Board (NDDB) has reported discrepancies in consumer packs of some imported milk products like cheese, butter, cream and milk. the discrepancies pertain to the labeling provisions and declaration of maximum retail price under the Prevention of Food Adulteration act (PFA) and standards of weights and measures (Packaged Commodities) Rules, 1977. The Government has taken some corrective actions. The Ministry of Health, which is responsible for administering PFA Act and Rules, has instructed all the State Governments to ensure that all food articles, whether imported or indigenously produced and marketed, are subjected to regular checking so that their quality conforms to the provisions of the PFA Act, 1954 and the PFA Rules, 1955. The Ministry of Commerce and Industry, on November 24, 2000, ordered that all such packaged products shall be subject to compliance with the import provisions.

SOYAMEAL

Soyameal exports to south east Asia are likely to increase due to a pickup in the Asian economy and some panic buying amid fears of a possible US attack on Afghanistan.

A senior ITC official said while South Korea had bought large amounts of Indian soyameal in the last few days, the Philippines, Thailand and Vietnam had been slow in their purchases.

Japan is due to buy 350,000 tonnes of soyameal from India this year, 100,000 tonnes more than last year because South American meal prices are higher.

According to sources, so far traders have sold 350,000 tonnes of soyameal from the new crop compared with nearly 500,000 tonnes contracted at the same time last year. Sales should be brisk in the coming weeks for deliveries between November and March since Indian prices were globally competitive. Indian high protein meal was being traded at $ 195 a tonne compared with $200 a tonne for South American meal with lower protein content.

Country's soyameal exports were expected to be around 2.3 m tonnes in '01-02 (November – October) against the current year's projection of a little over two million tonnes, said O P Goel, chairman, Soyabean Processors Association of India.

DOT ON LABELS FOR FOOD WITH NON-VEG ADDITIVES A MUST

Effective October 4, 2001 all food companies, from fortified atta and vanaspati to biscuits, ice creams, soft drinks and paneer, will have to compulsorily and "prominently" display a "brown dot" if their products contain any non-vegetarian ingredients.

Non-vegetarian foods have been defined by the government as those which contain whole or part of any animal, including birds, fresh water or marine animals, or eggs or products of any animal origin. Only milk or milk products are exempt.

The brown dot, signifying non-vegetarian foods, will have to be "close in proximity" to the name or brand name of the product, and be used in all advertisements, labels, containers and pamphlets, according to the notification issued by the ministry of health. In case manufacturers do not comply, they can be jailed on a non-bailable warrant for at least six months and face other penalties under the draconian Prevention of Food Adulteration Act,'55.

The government has refused the industry's argument that eggs are vegerarian. As a result, from now onwards, all biscuits and cakes using eggs and egg derivatives will have to be labelled as non-vegetarian.

The law does not specify any percentage above which an ingredient should be considered significantly present in a food product.

Consequently, even if the food contains only trace elements of a product of animal origin, the brown dot becomes mandatory.

INTERNATIONAL NEWS

ULTRA-CLEAN PROTECTION FOR FOOD PROCESSING

In France, many agro-food companies are incorporating various measures to control airborne contamination in food plants as an alternative to expensive cleanrooms. In cleanrooms, three types of equipment are necessary: an air treatment system, a diffusion system and a specific envelope that individualizes the room. However, there are some constraints limiting effective utilization of such permanent installations. Some of these barriers include: • Higher production rates as well as numerous human interventions disrupt the ventilation in traditional cleanrooms • With respect to higher productivity, the operating staff face difficulties in complying with the many strict procedures – appropriate clothing, air locks, etc. • Frequent cleaning and the resulting relative humidity damage cleanroom equipment – treatment units, filters and ducts.

Two patented "close protection" technologies have been developed by nine companies, based around the "ultra-clean" factory research programme. The companies involved are Cedilac, Luissier Bordeau Chesnel and Fromarsac, the Fleury-Michon Group, the Pernod Ricard Group, the Socopa Group, Sagal and the Danone Group. The first patent concerns equipment made up of textile ducts fabricated using technical fabric fitted with transparent flexible skirts. This system generates unidirectional vertical airflow consisting of slow air jets (0.3 – 0.5 m/s) bordered by fast air jets (0.8 – 1 m/s). These eliminate the introduction of any contaminated air from the production area on to the food products conveyor. ISO class 5 air purity is obtained in this way on the conveyor belt while reducing the flow rate from the air treatment unit by 41 percent and air-cooling by 32.5 percent. This device can be adapted to existing processes and saves up to 30 percent – in costs and maintenance compared with cleanrooms.

The second development is a progressive flow for the localized protection of food processing plants. A system of metal nozzles fitted on one side of the conveyor produces a graduated airflow that sweeps horizontally across the work surface of a conveyor belt. Air is returned and drawn in on the other side of the conveyor. This airflow provides a protective zone 10 cm high. The operator can intervene in this protected zone to remove a product without contaminating neighbouring products.

Other related developments include: • Clauger has produced a diffused ceiling comprising an air distribution system, and a diffusing fabric that ensures completely laminar airflow. These diffusion systems are designed for laminar flow dust removal workstations • La Calhene has adapted isolator technology from the nuclear industry, where a key invention is an airtight transfer double door developed to protect operators from alpha radiation. This innovative device enables close containment and aseptic transfers, particularly in filling or cutting lines.

REGULAR MILK DRINKERS ARE HEALTHIER

Researchers at Bristol University in Bristol, England, have found out that drinking whole milk is not bad for your heart. The research adds to a growing body of evidence proving milk is good for overall health. The study confirms that regular whole milk drinkers do not face an increased risk of heart disease, and, in fact, may be healthier by drinking milk. The 25 year study of more than 5,700 Scottish men 35-64 found that there was an 8% decrease in deaths from heart disease in men who consumed more than a third of a pint of milk a day compared to men who drank less. The study also showed that death from all causes, including cancer and stroke, was 10% lower among milk drinkers compared with non-drinkers. The study was published in Journal of Epidemiology and Community Health.

In recent years, consumption of reduced-fat and fat-free milk has been linked to helping the body lower blood pressure and fat levels as well as protecting against certain types of cancer in addition to helping build strong bones and teeth.

SOAKING MAKES RICE MORE NUTRITIOUS

In Japan, researchers have uncovered that the nutritional value of brown rice can be enhanced by soaking it for several hours before cooking. The germinated rice contains more fibre than conventional brown rice, three times the amount of essential amino acid lysine and 10 times the amount of gamma-aminobutyric acid (known to improve kidney function). The team also found that brown rice sprouts contain a potent inhibitor of an enzyme called *proctylendopetidase*, which is implicated in Alzheimer's disease. Reports show that germination

activates enzymes that liberate additional nutrients.

THE SPIRIT OF THE TORTILLA

The Tortilla Industry Association (TIA) was created in 1990 to serve the rapidly expanding tortilla industry, now the fastest growing segment of the baking industry. The not-for-profit organization assists companies in the tortilla industry with management, education and product promotion activities. TIA also addresses regulation, quality control and distribution issues and provides members with educational support through seminars, conventions and market research.

Based in Dallas, Texas, TIA is comprised of more than 180 international members including tortilla manufacturers, industry suppliers and distributors with interests in the rapidly growing tortilla industry.

As the nationally recognized representative for tortilla companies, TIA seeks to promote the consumption of this traditional Mexican bread for alternative uses in mainstream American cuisine, such as sandwiches, soups and desserts. Today, annual U.S. tortilla sales exceed all other ethnic and speciality bread sales, including bagels, English muffins and pita bread, with an annual growth rate over the past four years of 57 percent. During the year 2000, U.S. tortilla sales surpassed $4.4 billion. If tortilla sales continue to increase at this pace, they will reach close to $6 billion by the year 2002.

Tortilla is an unleavened Mexican flat bread or pancake made from corn, corn flour or wheat flour as its principal ingredient. The word "tortilla" comes from the Spanish word "torta" which means "round cake". Tortillas can be used as the plate, the envelope or the folder surrounding a countless array of delicious fillings like Salsa. There are two basic forms of tortillas - corn and wheat flour. The wheat flour tortilla is commonly referred to simply as a "flour" tortilla. Increasing in popularity are flavored flour tortillas that range from spinach to sun-dried tomatoes and garlic. Wheat flour tortillas are a low-fat food and contain iron along with other B vitamins. They have about 115 calories with 2-3 grams of fat per serving. Corn tortillas are a low-fat, low-sodium food and contain calcium, potassium and fiber. An average serving contains 60 calories with 1 gram of fat.

Tortillas have achieved "bread-like" acceptance in the U.S., as a non-ethnic food, and are making their way into many mainstream American dishes. Non-Latinos eat 65 percent of the tortillas sold in the U.S. The tortilla is the fastest growing bread-product in the world.

GOOD BACTERIA IMPROVES THE DIGESTIVE FUNCTION

Yogurts and fermented drinks containing 'good' bacteria have been embraced by the health-seeking public, and may not be merely a fad. These products, call probiotics, contain one or more types of bacteria from the lactobacillus family, promoted as being able to improve the digestive function.

According to findings presented at the Asia Pacific Digestive Week conference, probiotics may have a role in the prevention and management of serious gastrointestinal conditions including inflammatory bowel disease (IBD).

Scientific data to date on the health effects of probiotics has been limited, noted Dr. Ross Butler, chief medical scientist at the Centre for Paediatric and Adolescent Gastroenterology, at the Women's and Childrens' Hospital in Adelaide. However, he said, the bacteria do appear to promote intestinal health. He and his colleagues recently identified non-invasive tests that could provide a way to assess the effectiveness of probiotics.

HOT LEMON TEA CAN PREVENT SKIN CANCER

Drinking hot lemon tea could help protect the body against skin cancer, according to research carried out by scientists from the University of Arizona, situated in an area with one of the highest rates of skin cancer in the US. Of the 450 people studied, half had suffered with squamous cell carcinoma (SCC), a particular type of skin cancer.

Researchers Iman Hakim and Robin Harris quizzed participants about their tea drinking habits and discovered that those who had developed skin cancer drank significantly less hot tea. The study concluded that drinking black tea meant a 40% reduction in the risk of developing SCC. Importantly, the consumption of hot tea with lemon citrus peel was found to bring a more than 70% reduced risk of SCC.

Consuming iced tea drinks was less effective in the prevention of skin cancer however, because they were more likely to be diluted.

Hakim and Harris research studied the potential association between consumption of tea and/or citrus peel and risk of skin SCC and data showed that persons without skin cancer significantly consumed more citrus peel and hot tea than did cases of skin SCC."

Scientists hope the study will aid in the development of food supplements that can help prevent skin cancer. Currently, there are around 1.2 m new cases of non-melanoma skin cancer in the US every year, and that total is expected to rise with the depletion of the ozone layer.

The majority of skin cancer cases result from high exposure to ultraviolet (UV) light from the sun.

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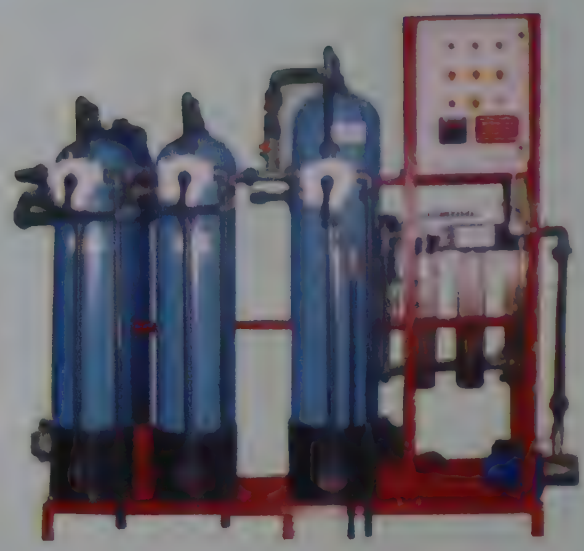

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PRODUCT REVIEWS

ALL METAL SEPARATOR

S+S all metal separator 'Rapid Compact' separates all ferrous and non ferrous metals starting from a size of 0.3 mm from free falling material. This avoids costly failures of processing equipments and increases productivity. It is used both for intermediate testing in the process and also for final packed product . Thus, it ensures quality, productivity and safety.

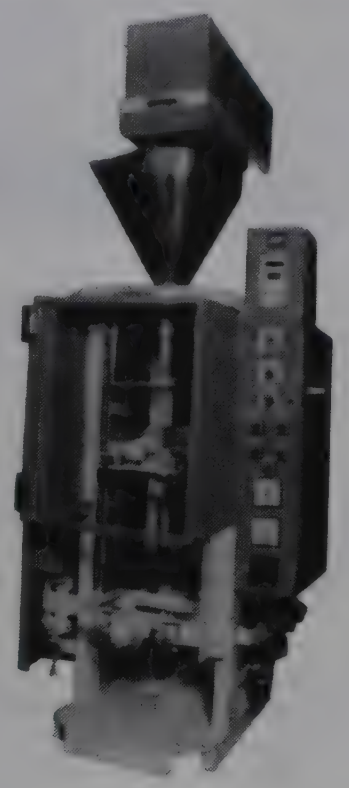
The Rapid compact is suitable in various industries such as food, chemical, pharmaceutical, plastics and textile. The decisive advantages of the Rapid Compact All Metal Separators are: • Extremely low overall height • Proven and reliable function over the years of operation • Automatic self balancing • Permanent self monitoring • Temperature compensation • On-line working • Type of protection: IP 65.

The additional facilities such as anti-static scanning pipe, remote control unit, warning blinker and reset facilities are also available as per customers requirements.

For further details, contact:

Rieco Industries Ltd.
1162/2, Shivajinagar
Behind Observatory
Pune 411005
Tel: 0212-5535215/5384 • Fax: 5533229
Email: package@rieco.com

FLEXIBLE PACKAGING SYSTEMS



Unique Flexo Packaging are manufacturers of Automatic Pouch Packing, Bottling Filling & Dosing Machines. The company under brand name "Unipack", offers a wide range of Automatic and Semi Automatic Machines suitable for packing various products.

The Speciality of Unipack machines are that they incorporate solid state electronic controls which makes the machines more reliable and gives trouble free performance.

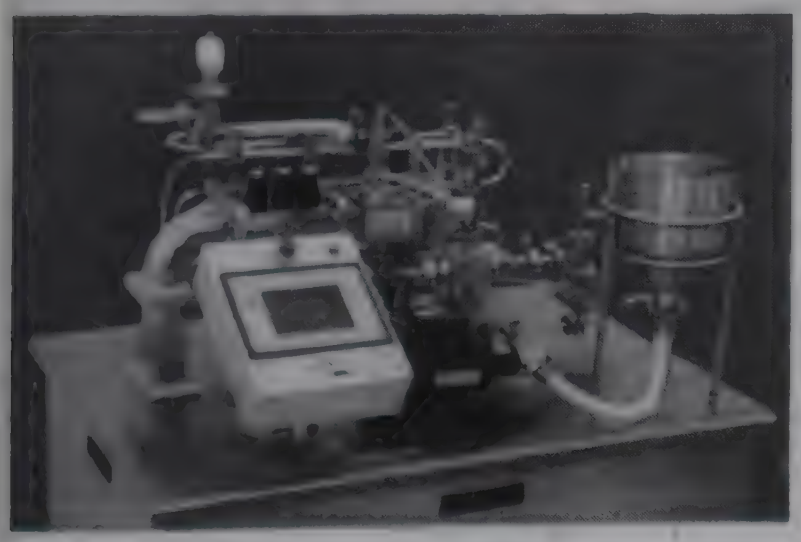
All contact parts are made of Foodgrade Stainless steel and is of study design. The speed of the machine can be varied very easily by just adjusting a knob provided in the control panel.

Machines can handle any heat saleable films such as L.D.P.E. BOPP, H.M.H.D. Polyester Poly etc. upto 550 gauge thickness in form of sheets. Machines can pack products like Instant food, Milk, Sauces, Juices, Spices, Food grains etc. Optional Extras like Visual Temperature Indicators, Emboss Coding in End Seal, Hole Punch attachment, Machine side covers & Jawguards, Additional Quick change Tube formers, Impulse sealing equipment are also available.

For your requirements, contact:

Unique Flexo Packaging
Work: B-270, Joshiwada
Off. Manpada Road, Opp. Kasturi Plaza
Dombivli East 421 201
Telefax: 436413 (R): 5745723
Email: unipack_2@hotmail.com
Website: http://www.uniqueflexo.8m.com

MICROWAVE PASTEURISER/UHT SYSTEM



Armfield range of miniature-scale equipment used by researchers and developers in the food and pharmaceutical industries, has developed Miniature-scale microwave pasteurises/UHT system which reaches 140°C in a second.

The FT84 unit is for very rapid heating of small quantities (0-20 litres per hour) of viscous, non-viscous and non-homogeneous products. Typical applications include baby foods, pâté, pasta, puddings, custard, sauces, soups, pharmaceuticals, gelatines and milk among others.

Rapid heating means product is less likely to be damaged through denaturation of proteins and vitamins and the Maillard reaction is less likely. Because microwave heats the products from the inside out heating is uniform and there are no hot walls on which it can burn.

FT84 Microwave pasteuriser/UHT system is a complete 64W microwave heating system. It includes a microwave application in which product is brought up to the desired temperature and a cooling section where cold water is used to provide the initial cooling of the product. This system can heat the product from 20°C up to 160°C in less than 1 second by means of a 64 W microwave heater. Raw material is loaded into the stainless steel tank and pumped through the microwave heating section for rapid heating. The product is held at temperature for a specific time using a holding tube positioned at the exist of the microwave heating section. After cooling in the tubular heat exchange the finished product leaves the system through an adjustable back pressure valve which maintains the necessary system pressure.

For your requirements, contact:

Armfield Limited
Bridge House
West Street, Ringwood
Hampshire, BH24 1DY England
Tel: +44 (0) 1425 478781
Fax: +44 (0) 1425 470916
Email: sales@armfield.co.uk
Website: http://www.armfield.co.uk

EASY-TO-USE TEST KITS

For the first time in India Rakiro Biotech, Mumbai introduces Easy-to-Use Test Kits for the convenience of Dairy Industry for all Chemical and Microbiological Tests.

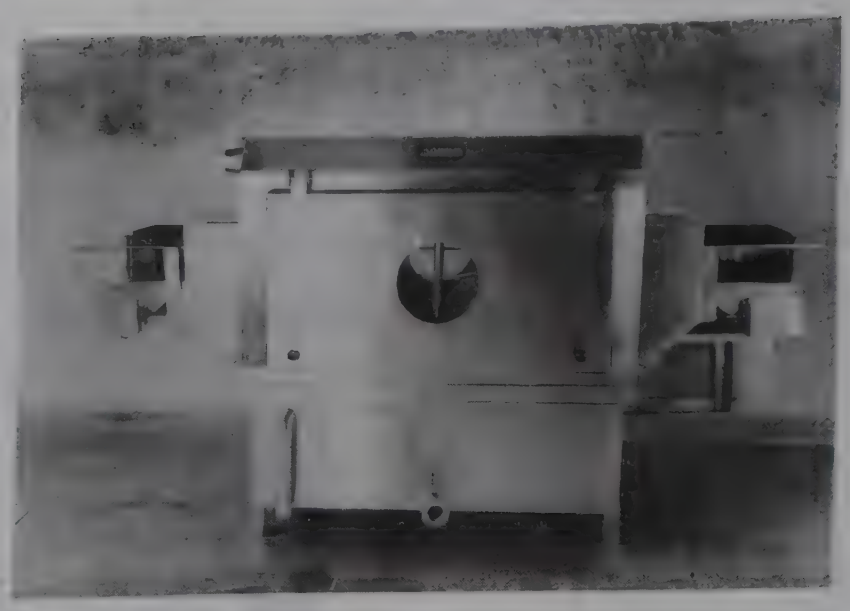
It identifies the problem within minutes and have strict quality Control on Raw Material and Raw Material Suppliers.

Easy-to-Use Test Kits have following Advantages : • Even non-experienced person can conduct chemical and microbiological tests • Assured, accurate reliable and reproducible results within shortest possible time • Handy disposable chemical and microbiological kits with money saving refill packs • No need for chemical and microbiological laboratory • Chemical tests for hardness, Calcium Hardness, Chloride, Free Chlorine, Alkalinity, Sulphite, Nitrite, Silica, Iron and Hydrazine can be estimated in minutes. Presence of bacteria responsible for spoilage of milk and milk products can be easily hydetected.

Write for detailed Free leaflets to:

Aquafilt Instruments & Systems Pvt. Ltd.
Wadala Shriram Ind.
Premises Co-op. Soc. Ltd.
Unit No. C-22, IIIrd Floor
13 G.D. Ambekar Road
Wadala (E)
Mumbai 400 031
Tel: 4118872/74/75
Fax: 022-4118869
Email: shahbros@bom5.vsnl.net.in

HIGH PRESSURE CRATE WASHER



Goma high pressure crate washer has been successfully working in various industries. The crates/trays are washed thoroughly by high pressure water jet only. There is no requirement of steam, detergent, chemicals etc. The machine is more compact and with minimum maintenance.

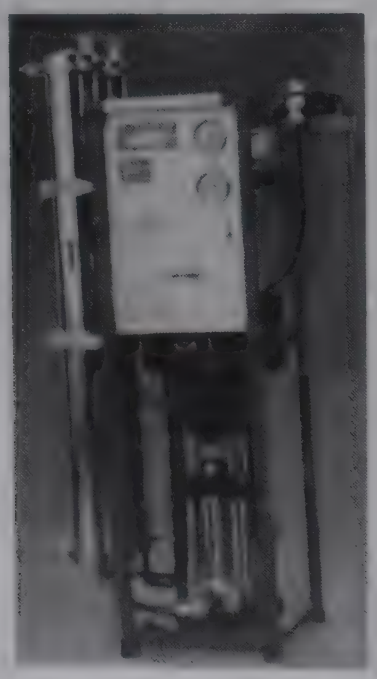
The crates/trays are conveyed automatically by conveyor chain fitted on stainless steel fabricated frame. The crates/trays pass through high pressure water jet nozzles having accurate spray angle for washing. The high pressure is generated by a high pressure pump driven through electric motor and mounted close to conveyor. The speed of conveyor is variable and can be adjusted to get optimum washing effect. The washing process is carried out inside th stainless steel fabr cated enclosure whic prevents all egress o water. The enclosur has a provision fo easily openable door for maintenance pur poses. Waste water i collected in a pump which can be con nected either to th sewage system or ca be reused passing through the special fil tration system. The whole machine is pro vided with adjustable feet for levelling and needs no fixing to the floor. A separate elec trical control panel is provided.

Advantages: • Fully automatic • Ensures optimum cleaning in the fastest possible time • Compact design for space saving • Time and man power saving • No need o steam, chemicals, detergents etc. • Low power consumption • Easy for operating and maintenance

For further details, contact:

Goma Engineering Pvt. Ltd.
Behind Universal Petrol Pump
Majiwada
Thane - 400601
Tel: 91-22 5340875/5346436
Fax: 91-22 533 3634/2
Email: goma@vsnl.com
Website: www.gomaengg.com

REVERSE OSMOSIS UNITS



Aguapuro Equipments carries a complete range Reverse Osmosis Units ranging from 100 to 5000 LPH.

Standard features include Pre Micron Filter, High Pressure Pump, Pressure tubes with Membranes, Electrical Control Panel with TDS meter and Wet Panel with Flow Indicators and Pressure Gauges, Pressure Switch and electrically driven Solenoid valve, Pressure Regulator valve, Powder coated steel frame (Skid) etc.

Optional features include Membrane cleaning system, Level switches, Low Pressure cut off switch, Automatic fast rinse flush, Low pressure safety cut-off switch etc.

The modular design allows for a wide range of flow rate ranging from 100 LPH to 5000 LPH. Larger flow also handled with custom made designs.

Systems are designed using the State-of-the-art Reverse Osmosis Technology using High rejection thin film RO Membrane. They also offer complete system with pre treatment of Chlorination Coarse Filtration, Carbon Filtration, Softening and Post Treatment of De Mineralisation, UV sterilization, Ozonation etc. for process and other applications.

For further details, contact:

Aguapuro Equipments
2/22 Panwala Building
Dr. S.S. Rao Road
Parel, Mumbai 400 012
Tel: 91-22-410 1432 / 415 5576
Fax: 91-22-410 1432 • Cell: 098210 78929
Email: aguapuro@vsnl.com
Website: www.aguapuro.s5.com

PACKAGING SOLUTIONS

The Automatic VF applicators from Graham Labelling Systems are among the fastest full body sleeving and tamper banding machines in the world.

The Graham VF range can accommodate containers up to 170mm in diameter requires minimal change parts and can apply sleeves up to 300mm in length They are suitable for empty and full, square and round profiled containers. With the addition of Graham's heat tunnels using hot air, radiant heat or steam, the range provides the complete shrink sleeving solution. Recent developments include a material accumulation system, which allows reel changes while the system is in full operation.

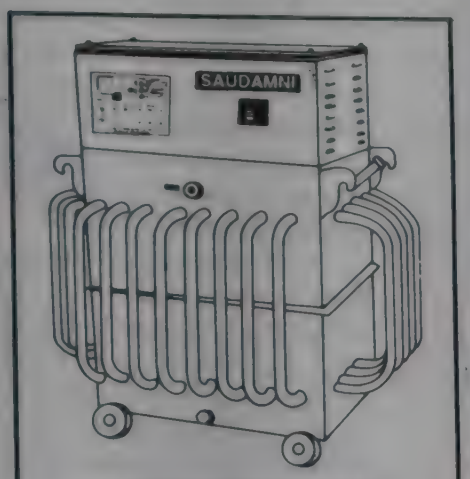
Once applied, sleeves shrink snugly on to the filled bottles using steam. This provides a smooth, even shrink and ensured that product within was not damaged/compromised.

For your requirements, contact:

Graham Labelling Systems Ltd.
Hallworks
Church Road, Brightling Sea
Essex CO7 OR2
Tel: 44 (0) 1206 304982

SAUDAMNI

AUTOMATIC SERVO VOLTAGE STABILIZERS



RATING-10KVA-1000 KVA

Manufacturers:

SAUDAMNI TRANSFORMERS (P) LTD.

15, VIPIN GARDEN, NAJAFGARH ROAD,
NEW DELHI-110 059. PHONE: 5640804

WARNER

PRESENTS

Wrap Spring Clutch/Brake

- Higher torque to size ratio
- Constant acceleration time
- Stopping error ±½°, non cumulative for model type CB
- Single revolution or partial revolution
- Maintenance free
- Mechanical or electrical actuation
- Upto 1200 cycles/min.
- Unidirectional clutch

Applications :
Business machines, Mechanical preses, packaging printing-wrapping stiching, anti-back driving, wrapping m/c etc.

For further information and application engineering assistance, Contact the Indian Representative :

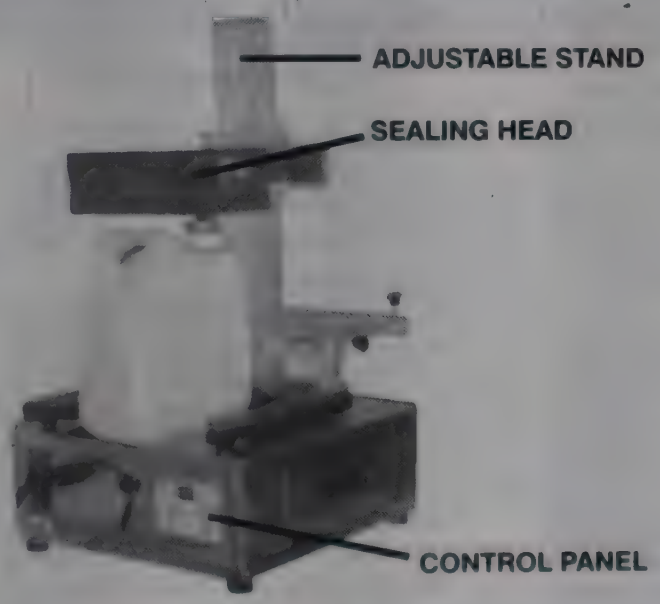
FRANCIS KLEIN & CO. PVT. LTD.

FLAT NO. 5, 'SOBA NOOK' II FLOOR,
HOTEL PARK VIEW LANE, S.NO. 1194 / 24+25+26/4,
OFF GHOLE ROAD., SHIVAJINAGAR, PUNE 411 005.

- TEL : 91-20-553 9770 / 553 9158 / 553 8536 / 553 8537
- FAX : 91-20-553 9771 / 080-2276324
- Email : francis@pn2.vsnl.net.in

Branches : Bangalore, Calcutta, Delhi, Hyderabad, Chennai, Mumbai

KOLLMORGEN SEIDEL • SLO-SYN • PACSCI •



SVELTE 500

SPANPAK SYSTEMS

INDUCTION SEALING MACHINE

- ❖ Power supply with advanced IGBT circuitry.
- ❖ Easy set-up: Just adjust sealing head height to container height, set alignment fixture and timer for necessary sealing power.
- ❖ Simple operation
- ❖ Digital Timer from 00 to 9.9 Secs.
- ❖ 3 power mode settings for required current levels.
- ❖ No cooling water required – air cooled.
- ❖ Input 230VAAC, 50 Hz 700VA.
- ❖ Output 500 Watts.
- ❖ Equipment designed to seal: 38mm - 110 mm between 6 to15 containers per minute, depending on the cap size.

Automatic Version of the same is also available for Online Operation and Higher Outputs

Other Products:

• Volumetric Liquid Filling Machine • Drum Filling Machine • Digital Piston Filler • Capping Machine • Conveyors

SPANPAK SYSTEMS

B-133, Ghatkopar Industrial Estate, Off L.B.S. Marg. Ghatkopar (West), Mumbai 400 086

Tel: 91 22-596 9839, 500 3378 • Fax: 91-22-500 8352 • Email: span_mkt@vsnl.net • Website: www.spanpak.com

MULTI-PACKER

Maxim™ multi-packer maximizes productivity, flexibility, and package design options for beverage producers. Modular design multi-packer runs 3000 cans/1800 bottles a minute, single- or double-tier cartons, with quick changeovers and level-best ergonomics - Maximizing beverage packaging productivity.

Modular design makes Maxim™ a multiple solution machine - custom-configurable to specific user needs. Modules available include single- or double-tier transfers, pad or slipsheet feeders for double-tier packs, partition feeds for bottle machines, infeed systems, diverter tables and more.

The versatile machines can be configured for everything from 2x3 to 4x6 single-tier packs and 3x3 to 3x6 (36 pack) double-tier cartoning. The Maxim™ runs virtually any commercially available paperboard or corrugated carton design existing today for both cans and bottles, including fully-enclosed square corners, open corners, beveled corners, two taper and four taper. This adaptability allows users full freedom in choice of carton design, carton material and carton manufacturer, without compromising speed or efficiency. Units can be configured for single-tier operation and later updated to double-tier capability.

A novel inverted carton feed, latest evolution of Jones' Orbi-Trak® rotary feed technology, lessens feed point pressure to improve efficiency and reduce the effects of bowed cartons in high humidity environments.

Stainless-steel, laser-cut frame enables easy cleaning and long service life, while walk-in design optimizes cleaning and maintenance access. Lexan-faced sliding doors provide full guarding protection while allowing full visibility of packer mechanicals and operations.

Selected by leading brewers and beverage producers, maxim multi-packers are backed by globally available parts and service support for the entire life of the machine, a tradition of R.A. Jones since the company's founding in 1905.

For more information, contact:

R.A. Jones & Company Inc.
P.O. Box 485
Cincinnati OH 45201 USA
Phone: (859) 341-0400
Fax: (859) 341-0519
Internet: www.rajones.com

SODIUM BENZOATE

Sodium Benzoate, well known preservative is manufactured by Ganesh Benzoplast Ltd. in their state-of-art plant at Tarapur, Maharashtra. Benzoic Acid is manufactured from oxidation of Tolueno, only route which gives food grade quality, and conforms to the 154467-1554 of Bureau of Indian Standards. The quality is checked regularly by their representative and GBL is the only company in this country, which manufactures food grade quality in form of powder, flakes and granules.

As per Prevention of Food Adulteration Act 1954, Sodium Benzoate falls in class 2 preservative and its use is recommended in fruit and vegetable juice, fruit pulp, beverages, squashes, crushes, fruit syrups, jam, jelly, marmalade, mineral water, pickles, chutney, tomato sauce, puree and pastes.

Its other applications are also being tested at shop floors, preservation of fish, spices and cakes are also new fields for sodium benzoate. GBL holds an ISO 9002 certificate and exports Sodium Benzoate to various developed countries like USA, UK, France, Germany etc

Fumaric Acid, Acidulent and Anti-oxidant, is manufactured by Ganesh Anhydride Ltd., at their state-of-art plant at Tarapur. GAL manufactures Maleic Anhydride under the same roof and converts it to Fumaric Acid.

There are many manufacturers of Fumaric Acid but it is bye-product of their Pthalic Anhydride plant. GAL manufactures food grade quality as per IS:6793:72 of Bureau of Indian Standards.

Fumaric Acid (food grade) is also recommended by PFA94 in fruit juices, tomato juice, fruit syrup, squashes, tomato sauce, ketchup, jam & marmalade and various fruit/vegetable sauces. The taste of Fumaric Acid is very near to tamarind and is being used in sambhar by many Southern Hotels.

It remains as free flowing powder and retains original flavour while citric acid absorbs moisture and frozen lumps. Its efficiency (sourness) is higher then citric acid, 3 parts by weight of citric acid is equivalent to 2 parts of fumaric acid.

This makes it a very cost-effective ingredient for various food receipes.

For further details, contact:

Ganesh Benzoplast Ltd.
Ganesh House
Marol Naka, Andheri (E)
Mumbai 400 059
Tel: 8502096, Fax: 91-22-8505529
Email: rkpl@vsnl.com
Website: http://www.ganeshgroup.com

FILLING MACHINES

Apex Electromec Pharma Pvt. Ltd., having industrial machine manufacturing experience of nearly two decades, has made its formidable foray in food and beverage Industry.

The company manufactures single and multiheaded automatic powder/granule Fillers. The accessories it offers for the filling line are swing and slat conveyor, turntable, endless packing conveyor and combicapping multiheaded machine.

Apex Electromec Pharma also offers Infrared Ray Dryers and Material Handling equipments like fixed lifter, mobile stacker, lifters and filter and round IPC.

For more details, contact:

Apex Electromec Pharma Pvt. Ltd.
16, Nitin Indl. Complex
Ghaitan Area, # 1, S.P. Road
Near Vaishali Nagar
Dahisar (E)
Mumbai 400 068
Tel: 8964096
Telefax: 8960263
Fax: 8968615
Email: apexppl@hotmail.com
Website: www.apexelectromec.com

SEMI AUTOMATIC POTATO WAFER PLANT

Sadanand Approtech Pvt. Ltd. have introduced for the first time in India innovative and inspiring solutions to manufacture Indian Snack Foods using modern methods of Frying, Roasting, Drying, Blanching, Boiling & Cooking.

The company has manufactured Automatic Potato Plants which have very low fuel and power consumption. These small plants can be installed and managed by small scale enterprises easily and it needs very small initial investment.

The Plants are standardized to offer 1.0 MT/day upto 50MT/day of finished products on batch or continuous basis as per requirements of the user. Energy conservation, excellent hygienic conditions, extraordinary quality of finished products in terms of appearance, feel, taste and shelf life, easy to follow clear operational methodology are the top benefits offered by these New Age plant and equipment.

State of the Art Plant works on most modern engineering concepts, all contact parts are made of complete stainless steel AISI 304. Filtration of Vegetable Oil, using indirect heating system thereby fuel saving and 100 percent depreciation being energy saving device are few extraordinary features of the plant.

Capacities : 50Kg/hr & 100 Kg/hr of finished product • Investments in Plant & Machinery : upto 15 lacs • Pay back period of invested money : 15 months • Power requirement : 15 HP

For more details, contact:

Sadanand Approtech Pvt. Ltd.
B-34, Mininagar, S.N. Dube Road
Dahisar (E), Mumbai 400 068
Tel: 6902332/8114536 • Fax: 22-8100348
Email: sadanandfoodmachines@rediffmail.com

SOLID STATE INDUCTION CAP SEALING MACHINE

Packagers of Oil, Pharmaceutical, Pesticides and Food products all turn to induction cap sealing to solve their capsealing needs. Maintaining a tamper resistant, air tight and leak resistant seal on packaged goods is foremost for packagers concerned with preserving the integrity of their products. Electronics Devices induction capsealing system, empowers packagers to seal from 10 to 120mm closure sizes closure sizes at desired line speeds.

Induction Cap Sealing Machine were developed to cater to the requirement of the Packaging industry. There are several distinct advantages to induction sealing. • Tamper evidence — deter pilferage • Leak Prevention — No rejection, hence enhanced profits • Increased Shelf life — product freshness • Assurance to the end user — win your customers confidence • A sealed product is perceived to be safe and hygienic.

Electronics Devices is the original manufacturer of solid state induction capsealing systems. As the leading supplier of induction capsealing systems worldwide, out continued commitment to quality and state-of-the-art technology drives our research and development further into the further.

Electronic Devices have supplied this machine to many leading industries all over the country and have even exported them to Egypt, Nepal and Abu Dhabi. The customers include leading Oil Companies, Food, Pharmaceutical and Pesticides Industries.

Their machines are very rugged and reputed to give trouble free service. All the components are highly over rated to give continuous duty operation. These machines are designed for 24 hours a day, 7 days a week continuously operation.

The company offers a complete lab and test facility to test the materials for the most economical system, determine line speed capabilities and ensure the proper fit between the conveyor and the capsealing system.

For further details, contact:

Electronic Devices
31, Mistry Industrial Complex
M.I.D.C., Cross Road 'A'
Andheri (E)
Mumbai 400 093
Tel: 91-22-8221649/8394629
Fax: 8217443
Email: info@electronicsdevices.com
Website: www.electronicdevices.com

SPRAY DRYER

Lab Plant, UK, has a supply range of equipments designed for R&D in Laboratories and for scale up areas. With 30 years of experience of custom manufacturing various equipment are supplied.

Distillation Systems : • Designed to provide high efficient and simple operation with unique and innovative features. Four standard options available are Short Path Wiped Wall, Thin Film Evaporation, Packed Column and Rising Film Evaporation • Internal condenser provides a short path for the vapours as they travel from the heated wall to the condenser making it possible to operate at pressure as low as 0.001 which is difficult with other methods • Wiped wall ensures efficient distribution of sample over heated surface and with short path combination ensures maximum efficiency in the separation of heat sensitives product • Wiper System consists of PTFE. rollers with magnetic drive of 0-700 RPM requiring no seals • Systems in Glass or S.S. also can be supplied • Thin Film Evaporation is used for production and processing of low or micro molecular organic substances. Medium to be distilled is exposed to heat for a short time because film created by the wipers evaporates very quickly. Operating pressures go upto 0 to 5 m bar to assist rapid evaporation process • Packed Column Distillation designed to use Sultzer or Knitmesh packing in size range of column with 25 to 75 mm dia bore and 400-1500 mm long with 1 to 100 litres capacity. It can be in both glass or S.S. jacketed vessel • Rising Film Evaporation is simple and widely used method for concentrating fruit and vegetable juices, milk products, extracts etc. System is with two glass calandria tube evaporators with maximum evaporation rate upto 20 litres/hr. Unit is ideal for laboratory or small scale pilot plant using thermostatic oil circulator.

For your requirements, contact:

Hemraj Enterprises
Engineers and Consultants
603, Betsy Building
68, Marve Road, (Opp. HDFC Bank)
Malad (W), Mumbai 400 064
Tel: 862 7334
Telefax: 0091-22-862 8727
Email: hemaj99@hotmail.com
Website: www.hemrajindia.com

REVERSE OSMOSIS SYSTEMS FOR WATER PURIFICATION

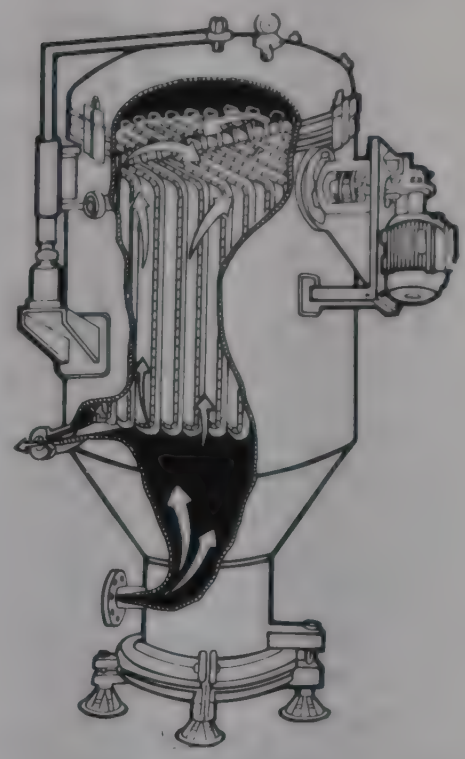
When we discuss "high purity" drinking water we are specifically talking about water for which virtually all types of unwanted contamination have been removed. This includes organic chemicals such as TCE, pesticides and all other carbon-based materials, inorganic salts such as sodium, metals, lime, nitrates, radioactive materials and biological growth such as bacteria.

Komal Industries is a water treatment manufacturer dedicated to offering their customers the finest commercial, industrial and medical Reverse Osmosis systems. They are committed to providing the most innovative and technologically advanced quality systems to their customers at reasonable technologically advanced quality systems to their customers at reasonable prices. Their knowledge and experience enables them to manufacture most of RO system's parts in-house to ensure quality system. Komal also tests every unit prior to shipping and supplies each customer with all the best data for their systems. Komal has a system suitable for both city water as well as highly contaminated brakish well/bore water. Wide range of standard Systems are available. Komal manufactures small System for office/residential purpose to industrial RO having capacity ranging from 50 lit/hr. to 1700 lit/hr in standard models. Higher capacity RO are made as per the client's specific requirements on turnkey basis. Komal's dedicated and professional customer service and technical personnel are always ready to assist their clients in a timely manner with any questions on servicing or installation.

For further details, contact:

Komal Industries
108 Creative Ind. Centre
12 N.M. Joshi Marg
Lower Parel (E)
Mumbai 400 011
Tel: 3091090/3091174
Fax: 022-3062711
Email: komal@komalwater.com
Website: www.komalwater.com

PRESSURE LEAF FILTER



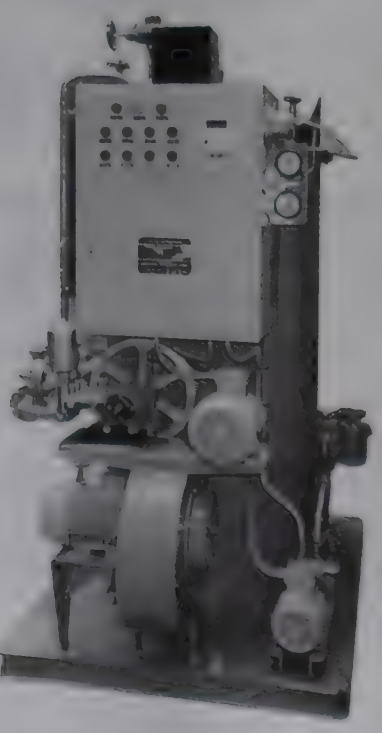
Amar Equipments Pvt. Ltd. manufactures Pressure Leaf Filters which consist of vertical mild steel/SS vessel with a number of vertical stainless steel filter leaves. Since both sides of leaves are used for filtering, a large filtration area is obtained in a relatively small vessel. The filteration is done with filter aid. The oil/chemical slurry is pumped into the filter. A filtering layer of filter aid is formed on the leaves and the filteration starts. The filtered oil/chemical is taken to the outlet through the manifold. The solid accumulates on the filter leaves & a thick cake is formed. When the pressure reaches 3-3.5 kg/cm sq the filteration is to be stopped, the cake is dried with steam/air and discharged by a mechanical/pneumatic vibrator through a large sized bottom outlet and hence no opening of filter (from top) is required for cleaning of leaves.

No filter cloth is required for filteration, hence there are large savings over plate & frame type of filter as the latter involves very long cleaning & maintenance period as well as cost of filter cloth. Rate of filteration is very high. Oil/chemical retention in filter cake is very low. The operating vessel is close and compact, so operation is very clean. The filters are available in sizes of 5m. sq. to 40m. sq. area.

For further details, contact:

M/s. Amar Equipments Pvt. Ltd.
6, Parmar Industrial Estate
Bel-Bazar, Kurla (W)
Mumbai 400 070
Tel: 91-22-5140169, 5109565, 5953029
Fax: 91-22-5953028
Email: amarengg@vsnl.com
Website: www.amarengg.com

GENERATOR



Malhar Industrial Associates, a Technocrat led company offers Non-IBR Hot water generators & Stream Generators, with a money back guarantee on performance of the machine in customers plant.

Best quality of Raw materials like seamless pipes for coils, high tensile fasteners, stainless steel reflector shell and other components are bought from best of the brands like Siemens, Bharat, Bijlee, Finolex, English Electric, Fenner, Danfoss, thereby makes these units very strong and trustworthy. Detailed engineering makes these generators user friendly, efficient and dependable.

Hot water generators from 50,000 K.Cal/hr. to 2 lac Kcal/hr. NIBR Steam Generators from 100 Kg/hr. to 600 Kg/hr. The company has also developed machines for manufacturing Gulabjamun, Doda burfi, Mawa/Khoa, Rossgulla, Kaju Burfi, Shrikhand, Basundi etc.

For more details, contact:

Malhar Industrial Associates
B-3, Harish Industrial Compound
Royal College Road, Penkar Pada
Mira Road (East)
Dist. Thane 401104
Tel: 6902335
Fax: 91-22-8100348
Email: malharsweets@vsnl.net

SPROCKETS WHEELS

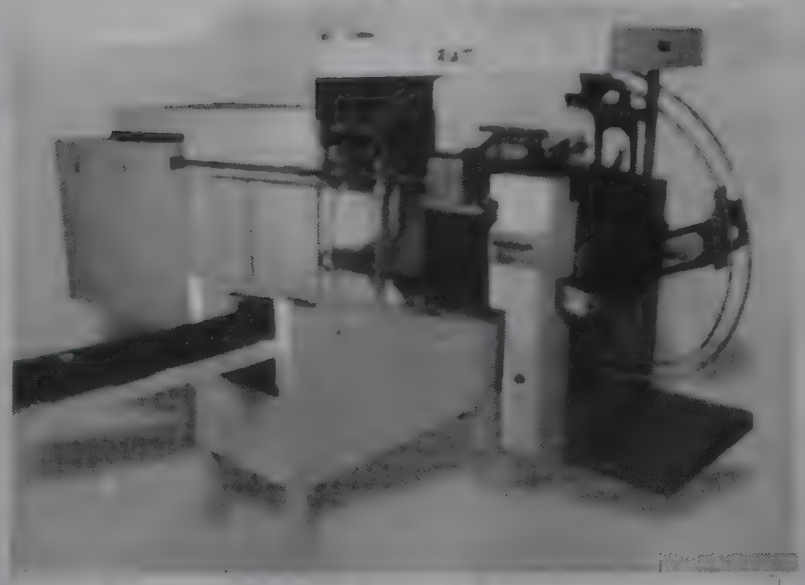
Meritt Roller Chain Sprockets are available from stock in sizes ranging from 6mm to 63.5 mm pitch BSS inclusive. All sprocket teeth are machined according to BSS tooth profile design for single and multiple strand roller chains. These sprockets are also available in cast iron, cast steel, carbon steel, stainless-steel etc., with and without flame hardening heat treatment as required.

Meritt also offers complete line of sprockets for conveyors and elevators. Cast tooth sprockets are generally used, however, flame cut or machine-cut sprockets can be furnished when required. These sprockets are also available in a wide-variety of material and are designed with rim and hub proportion that combine high strength with minimum weight.

For further details, contact:

Meritt Transmissions
157/159, Narayan Dhuru Street
Behind Nagdevi Street
Crawford Market, Mumbai 400 003
Tel: 3444956, 3442857, 3428342
Telefax: 91-22-40788268
Gram: Seawizard
Email: meritttransmissions@vsnl.net
Website: merittransmission.com

BAKING MACHINE



R&D Engineers are India's first & foremost manufacturers of Wafer biscuit & Ice-cream cone machines. Their years of experience and with the application of latest design and technologies to meet exacting market demand. Their product ranges from small table top machines to fully automatic machines. They also design and supply tailor made solutions to an individual customer need.

R&D Machines are characterized by highest standards in precision, in operating ease, utmost durability and service life.

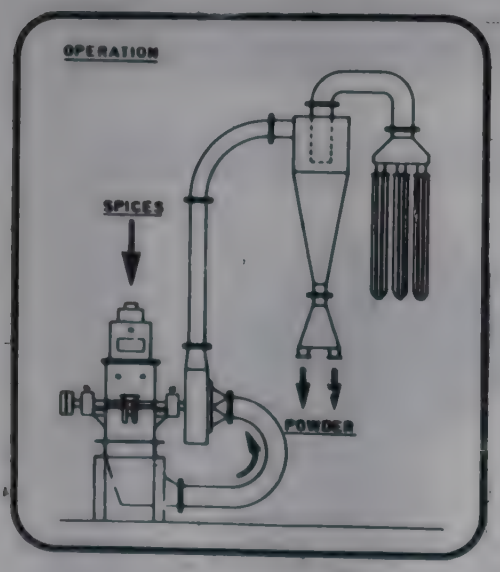
The "ZE" series of semiautomatic machines are used fo baking ice crean cones, sugarcane an cups. These machine are easy to use and are robust. The heating i by electrical heater designed to optimize energy use and therma distribution, still flexible for high production on nonstop basis for 24 hours.

The machine manufactured by them are Ice cream Cone baking machine, Batte mixing machine, Automatic Wafe baking machine, Manual Baking Tongs, Rolled Sugar cone machines, Automatic and Semi-Automatic baking machines.

For more details, contact:

R&D Engineers
A-41, IDA Kukatpally
Phase II, Road No. 4
Via I.E. Gandhi Nagar
Hyderabad 500 037
Tel: 3079121, 3079878
Fax: 91-40-3078668
Email: randengg@hd1.vsnl.net.in
Website: www.rndwafers.com

MASALA MILLS



The Masala Mill from Lithotech Engineers can be used for products such as chillies, turmeric, cori ander, mixed spices, dehydrated onions and garlic, etc.

The machine chamber consists of swinging hammers side liners and top liners. As the material is fed into the machine through the feeding hopper, it gets pulverized between the swinging hammers revolving at a very high speed and the liners. The perforated screen fitted in the lower part of the chamber regulates the fineness of the pulverized material depending upon its hole diameter. Once the material passes through the screen, it is sucked in by a blower unit mounted on the side of machine, which passes through the pipe, cyclone collector and finally discharged through the two way discharge valve. The air along with the very fine powder will go into the dust collector, where the material will be trapped into the filter bags and the air will be let out. The attachment of the dust collector ensures dust free operation. The free circulation of air into the machine keeps the chamber cool, thus retaining important properties of spices like taste, flavour and colour.

Salient Features are: • Retention of important properties of spices like taste, flavour and colour • Maintains uniform quality of product • Easy and economical dust free operation • Wide range of production capacities • Easy and economical maintenance • Sturdy construction • Ready availability of spares • Reliable after sales service.

For further details, contact:

Lithotech Engineers
S-2/B-25, Sector 10
Shantinagar
Mira Road (E), Thane 401 107
Tel: 8110182 / 8113648 / 8113617
Fax: 91-22-8105808
Email: lithotech@vsnl.com

CORRUGATED TUBE HEAT EXCHANGE

ECOFLUX corrugated Tube Heat Exchangers have been introduced by Praj Industries of Pune. These are specially designed to meet the hygienic requirements in fruit processing applications like fruit pulps, purees, juices and slices.

Corrugated patterns on the tubes offer better heat transfer co-efficient and uniform temperature distribution, thereby maintaining the consistency and quality of the end product.

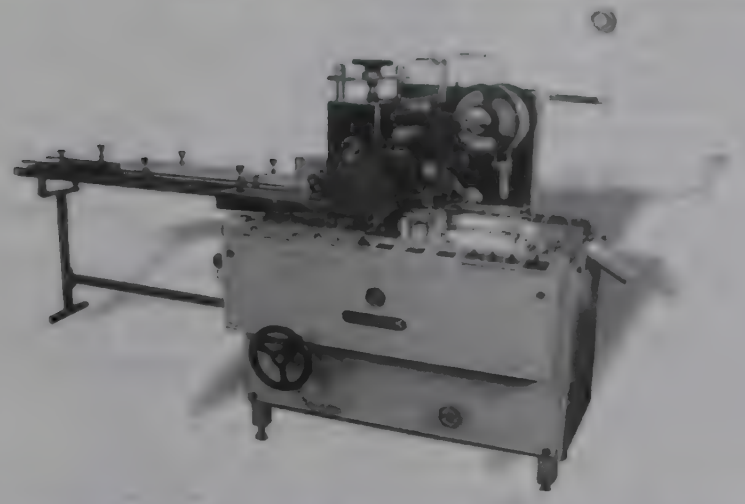
The ECOFLUX Exchangers offer significant advantages over conventional methods i.e. • Compact sizes, saves on space • longer running time, as the turbulent flow reduces fouling • ease of inspection and cleaning ensures lower downtime • low product hold-up • high response to CIP which reduce changes of product contamination • shorter residence time • no moving parts, hence lower energy consumption • double, triple or multi-tube construction for different applications.

For further details, contact:

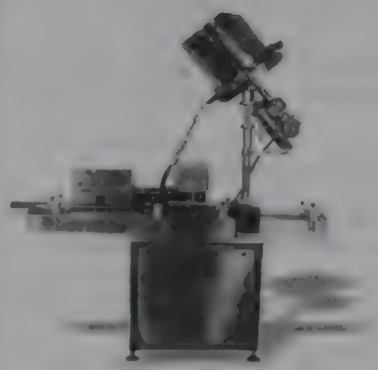
Praj Industries
Praj House, Bavdhan
Pune - 411 021
Tel: +91 20 5884214 / 5884311
Fax: +91 20 5884218 / 5885215
Email: info@praj.net
Website: www.praj.net

JET PACK

Mfgr. of Packaging Machines for Food, Beverages, & Pharma Industries

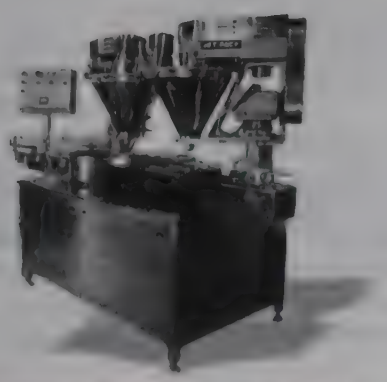


Food Products cartons premixes cartons overwrapping M/c.



Cap Pressing Machine

Cream Paste Filling Machine



Semi Automatic & Automatic Powder, Spices & Masala Filling

Other Ranges of Machines from JET PACK

- Powder Filling Machine
- Cream Filling Machine
- Volumetric Cupfiller
- Liquid Filling Machine
- Capping Machine
- Rotary Sealing Machine
- Automatic Carton Over Wrapping Machine
- Horizontal Flow Wrapping Machine
- Neck Sleeving Machine
- Aluminium Foil Sealing Machine
- Automatic Coding Machine
- Insert Pressing and Sealing Machine

For Details Contact

JET PACK MACHINES

C-18, Nandjyot Indl Estate, Safed Pool, Kurla-Andheri Rd, Sakinaka, Mumbai - 400 072. Tel: 851 6489 / 851 5561 / 856 0800
Fax: 851 6489 Email: jetpack@vsnl.com

TECHNOVATION MAP HEADSPACE OXYMETER MODEL EC-500

MODEL EC-500 CAN CHECK THE % OXYGEN INSIDE FOOD PACKAGES

LOW-COST, INDIGENOUS & DEPENDABLE

TECHNOVATION

ANALYTICAL INSTRUMENTS PVT. LTD.

MANUFACTURERS OF GAS ANALYSERS

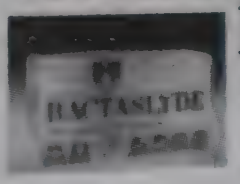
204 Deccan Court, 259 S.V. Rd, Bandra (W), Mumbai-400 050
Tel.: 643 1585, 641 3288 Fax: 640 2640, 645 8870
Email: taipl@vsnl.com • www.technovationindia.com

Did you know that invisible Monsters are eating into your product quality?

Yes, Bacteria!

Bacteria cause : • Spoilage of food products, Milk and Dairy produce • Spread of decease through water and food products • Reduction of product quality and shelf life

Now detect Bacteria easily with



BACTASLYDE

Microbiology laboratory not required

- Can be used by **anybody**
- Extremely easy to use and quick
- No capital investment • Economical
- Can be used at site very effectively.

BACTASLYDE can be used for detecting microbial contamination of all kinds of materials viz. Metal working Fluids, Process waters, Foods, Soft drinks, Paint and Pigments etc

RAKIRO BIOTECH

1 New Modella Industrial Estate, Padwal Nagar, Wagle Estate, Thane - 400 604
Tel.: +91 (22) 583 6846

PASTEURISER

Synonymous to their name "Super Care Industries" strategy is super care from the span of blue print and designing till the installation of plant at their customer's site with the utmost care and commissioning into operation, free from all hassles with strong backup of after sales services.

Their supreme inclination is towards the profitability of the organization has earned the "Name of Repute". Pasteurizes and Softeners specifically to the Dairy Industries are their HALLMARK. They are leaders in Suga Syrup making Machines both in Steam and Electrical Version.

Special Reactors : • Of highly volatile fragrances Oil which can be not be reacted outside the vessel • Self Wing reactors in which Ingredients are not preweighted.

They also offer Equipments with regard to water treatment and its allied equipment like water treatment plants D.M. Plants, R.O. Systems, Softeners Mineral Water Plants, Bottle Washing Machine S.S. Storage tanks.

For your requirements, contact:

Super Care Industries
Engineers and Consultants
Electrical and Mechanical
404A, Kirti Shikkar Building
Janakpuri
New Delhi - 110 058
Tel: 5557732 • Mobile: 9810216388

BAGGING MACHINE

Wraptech Machines Pvt. Ltd., offers a fully automatic PLC based Vertical Form-Fill-Seal Machine for powders, free and Non-free flowing, Granules, Pulses, Beans, Spices, Soups, Detergents, Yeast, Desserts Pharmaceutical and Agricultural Powders, Tea, Coffee, Sugar, Rice etc.

A vertical form, fill and seal machine for producing centre sachets handling all types of free flowing / non-free flowing powders / granules.

The above machine handles a single reel film stock. Max. reel dia. is 500 mm on 76 mm core. The machine has the capability to be provided with a variety of filling heads like Volumetric Cup (Telescopic), Auger Filler, Weigh Filler, Count Feeder, Index Conveyor belt. Draw down of the film is through draw down belts controlled through a electromagnetic clutch brake combination. The length of the bag is controlled by print registration system which is PLC based. For unprinted film the bag length can be adjusted from the single touch key pad provided on the front panel.

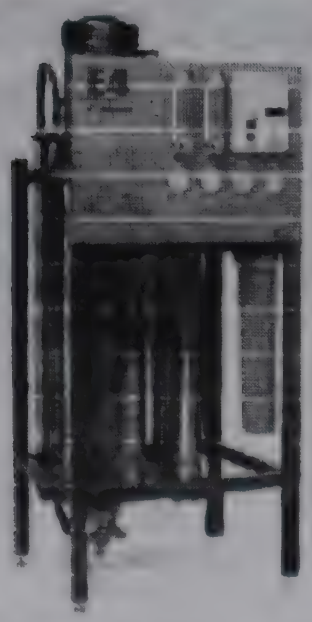
Special Features: • PLC controlled with XBT membrane keys • AC Inverter drive for main motor speed control • Adjustable draw down belts • Detachable perspex and stainless steel guards, easy for fault finding • Power reel unwind • Can be adapted to seal unsupported films using impulse sealing system • Inbuilt self diagnostic features • PC uplink facility • Password protection for settings • Hourly production data • Overload protection.

Machine packs 50 packs per minute depending on the product type and flow properties.

For more details, contact:

Wraptech Machines Pvt. Ltd.
Dharamchan Industrial Estate
Deonar Village Road
Mumbai 400 088
Tel: 551 2138, 558 3596
Telefax: 91-22-557 0726
Email: abm@wrapmachines.com
Website: www.wrapmachines.com

INDUSTRIAL SOFTENERS



Techno Aquatreat Pvt. Ltd. offers varieties of ROS with pre engineered standard configuration to ensure maximum efficiency and performance in economy and deluxe packages with Multi-stage centrifugal pumps with variable concentrate and re-cycle flow control valves to have the flexibility. Instrumentation systems, vertical flow design to provide high volume output and a small installation foot print as "Consumers Delight and competitor's Envy".

TATPL offers package, Industries Softeners and custom made systems to Food Processing and Beverages Industries especially Dairy Industries as well Industries like boiler fed, Textile Processing, Cooling water Treatment Air Conditioning Plants, Hotels, Hospitals and Laundries, Pharmaceuticals Industries.

For National Capital Territory TATPL is SEACTOR's authorized distributor for electro chlorination systems for water Disinfection Sector Mac^{R} in five model of Titanor Components Ltd. TATPL offers filtration plants, activated carbons filter plants, Mineral water plants, S.M. plants and Iron Removal plants. Also deals in consumables and spares for all the equipments.

For your requirements, contact:

Techno Aquatreat Pvt. Ltd.
Sukhdev Vihar, New Delhi - 110025
Tel: 011-91-6917749, 6917283 (R): 6235461
Email: <technoaqua@satyam.net.in

PROTEIN HYDROLYSATES & PAPAIN

Vashist Impex offers high quality spray dried Protein Hydrolysates from casein, soyabean, meat and liver used in food, and beverages. They also offer high protein suppliments, feed suppliments for animal and poultry feed, tanneries, Breweries & Bakery products.

Papain is made from papaya latex which has wide applications in food, bakery products, breweries, tanneries etc.

For further details, contact:

Vashist ImpEx
Gaumukh Bhavan, 2nd Floor
18 Masjid Bunder Road
Mumbai 400 009
Tel: 3778830/2312955
Telfax: 3736445
Email: vashist1@vsnl.com

Attn : ***Pharma, Food, Bakery, Icecream, Beverages, Biscuits, Flavours, Confectionery, Paint & Cosmetics Industries***

FOR YOUR REQUIREMENT OF THE FOLLOWING READY STOCK ON BEHALF OF OUR PRINCIPALS :

Sodium Stearoyl Lactate (SSL), Glycerol Mono Stearate (GMS), Poly Glycerol Polyricinoleate (PGPR), PAN Release Emulsion (Actilease), Baking Premixes (Actimix) from : ***Ganapati Adumim Emulsifiers Ltd.***

Lactic Acid IP/Food Grade, Sodium Lactate, Buffered Lactic Acid, Purac CL, Calcium Lactate Pentahydrate, Ethyl Lactate, etc. from ***Purac (Fareast) - Netherlands***

Benzyl Salicylate/Vanillin/Ethyl Vanillin from : ***Rhodia Chemicals India Ltd.***

Bayferrox 303T/110M, Red/Yellow 3920/3910/130 various grade From ***Bayer (I) Ltd.***

Sodium CMC from : ***Daicel Chemical (Japan),*** Flavours from : ***Duckworth Flavours (I) Ltd.***

2,3,5 Trimethylpyrazine, 2,3, Pentanedione, Sulfurol, Orange 5/10/20 (Folded), Mandarin Oil Single/5 fold, Grape Fruit Oil, Natural Valencene from ***Frutarom Ltd.*** ❖ Triacetin from **Acordis Fine Chemical**

Misc : Menthol, Peppermint Oil, Anethol, Aniseed Oil, L. Carvone, Spearmint Oil, Eucalyptus Oil, Frescolat – ML, ML Crystal, MGA (Menthyl Lactate) from **H & R Germany**

for Confectionery, Cosmetic, Perfumery Industries – Cooling Agent

Contact : **PRABHAHARI EXIM PVT. LTD.**

B-3, Nirmal Indl. Estate, Next to V.V.F. Ltd., Sion (E), Mumbai - 400 022 ● Tel: 22-4091833, 4093210 ● Fax: 22-4082703 ● Email: pfarma@bom8.vsnl.net.in

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The Company's S.S.I. Regn. No. is 55/55/PMT/SSI/08/084/00829 dated 05-01-95 and is a leading manufacturer of the following machines for the past 10 years

PACKING MACHINES

ON EDGE PILLOW PACK MACHINE, Model No. NII/HOM/100 (See pic.)
This model is suitable for packaging biscuits without inner wrap. The machine is specially designed with automatic feeding arrangement to precisely take the required stacked length and transfer the biscuits smoothly into the main feeding conveyor. The electronic digital temperature controllers maintain the accuracy of temperature for different packing materials. Speed is 40-100 packets per minute according to the size of the products.

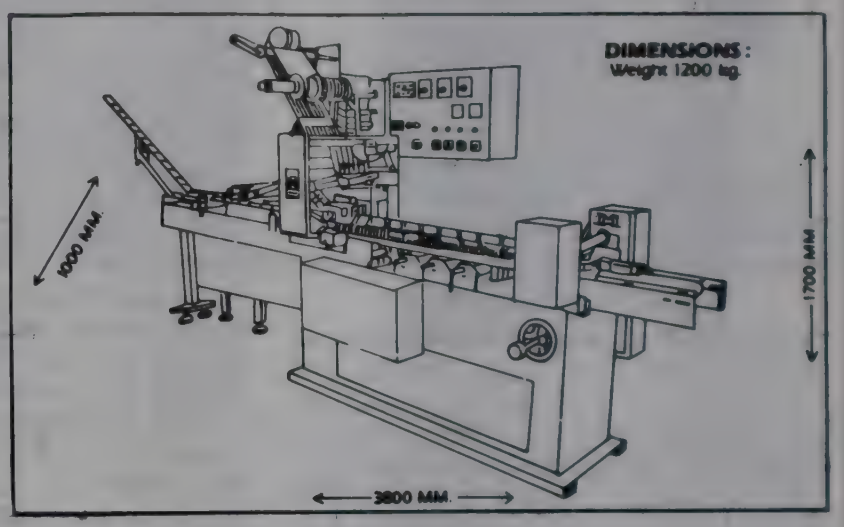
HORIZONTAL, PILLOW PACK MACHINE, Model No. NH/HPPM/150: This Model is suitable for packing prepack Biscuits, Ice, Candy, Soaps, Cream Wafers, Auto Spare Parts or nay other product which can move on Conveyor Belt without falling. More than 70 Machines are giving excellent service to our clients in India, Nepal & Bangladesh.

CANDY PACKING MACHINE, Model No. NII/CPM/400: This machine has speed of 350 Candies per minute. Machine is of the finest quality. Recently "National Products, Bangalore" has placed order for 5 Machines.

CANDY TWIST WRAP MACHINE Model No. NII/CTW/300

The Company also manufactures Wafer Cream Spreading and Wafer Cutting Machines and Tubes Expanders.

The List of customers include Cadbury India Ltd., Albert David P. Ltd., Kwality Ice Cream (Pvt.) Ltd., S.K. Industries (Mahak Pan Masala), Katana Food, Nutrine Confectionery, Bakeman, K.R. Biscuits, Amba Products, Crown Biscuits, Himani Limited, Mother Dairy, Creamica, Sweethome, Nilgiri Chocolates etc.



NEW INDO INTERNATIONAL (REGD.), 135-A, Begumpur Malviya Nagar, New Delhi 110 017

Tel: Fact: 6687476, 6683289 (R): 6514226 * Fax: 011-6688290 * Email: nii@ndf.vsnl.net.in * Internet: http://www.newindo.com

---

Since 1981, SATISH ENTERPRISES is one roof for source for Marking and Coding requirements in Beverages, Food and Pharmaceuticals Industries.

- ❖ Compatible Inkjet inks/make-up for CIJ Printers like Videojet®, Domino ®, Willet ®, Linx ®, Imaje ® etc
- ❖ Hot Ink Rollers for Hot ink coder like Markem ®/Kortho® etc.
- ❖ Coding & Marking Machines
- ❖ Rubber Stereos (Cliche')
- ❖ Coding & Marking Inks
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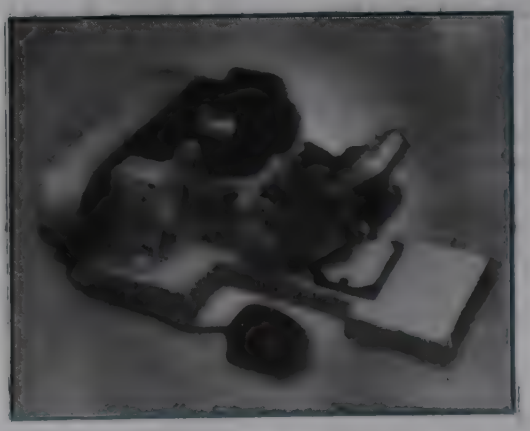
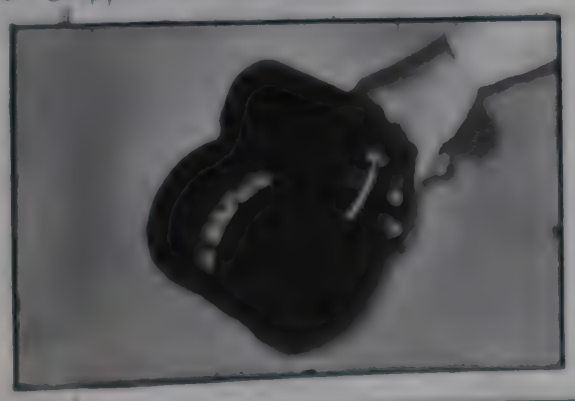


BATCH PRINTING MACHINES



HOT INK ROLLER

SATISH ENTERPRISES

Office: - A-3/62, Janak Puri, New Delhi 110 058

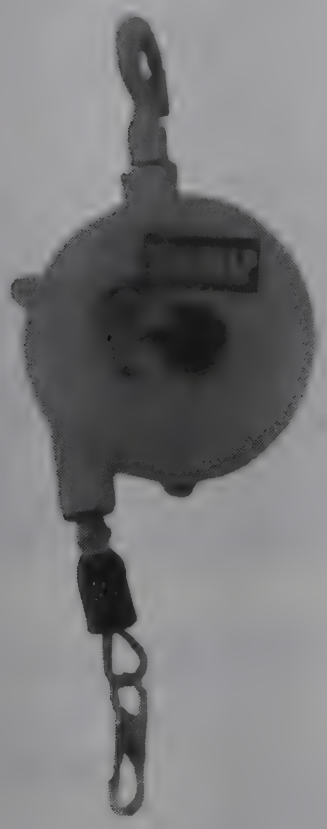
Tel: 91-011-5516904, 5535353, 5502859 * Fax: 5553563

Branch: 1702-3/108, Bhagirath Palace, Chandni Chowk, New Delhi 110006

Email: codeprnt@bol.net.in / info@satishenterprises.com

Website: www.satishenterprises.com

SPRING BALANCERS



Hasolon Spring Balancers are well received in industries as efficient auxillary tool for handling portable tools and equipments on shop floor. The tool takes away load from the operator and reduces fatigue thereby helping to increase productivity and tool life. The balance takes weight of the tool allowing the operator to concentrate on his work. Operator only needs to guide the tool while working. Features includes : • Heavy duty long life spring • Easy tension adjustments - no tools required • Quick installation • Durable Nylon covered steel rope • Convenient snap type tool clip • In-line alignment of hanger and tool hook • Longer life of cables and hosepipes in achieved.

Application includes: Suspending portable spot welding guns, pneumatic tools, portable electronic goods, spray painting guns, gauges, fixtures, hydraulic tools, bag closing machines, switch buttons of hoists, grinding tools, angle grinders, engine assembly line of scooters, trucks, cars, motor cycles etc.

For your requirements, contact:

Yogdeep Enterprise
A-20, Sarvonnati Society
Hansoti Road, Cama Lane
Ghatkopar (W)
Mumbai 400 086
Tel: 514 9190, 511 6469, 516 3817/3923
Fax: (022) 511 1173
Email: yogdeep@mantraonline.com

ICE CREAM MAKERS

Bravo (Italy) --- Offers high quality Softie Ice-cream machines, Slush Machines and Ice-cream cabinets (Display Units). They offer "TRITTICO", a unique machine as it simultaneously pasteurizes, mixes and whisks both ice creams and a wide range of high quality confectionery. It saves ice-cream makers and confectioners an enormous amount of time and space, hence increasing their earnings. Bravo also offers "STARTRONIC" used for making high quality ice cream in a very short time. It is quick and simple to use. They also present you a variety of fad display units like vertical, modular, double joined, ventilated cabinets with angular rectangular tubs with display versions from 14-24 tubs, double ventilated with display versions from 12-24 tubs.

For your requirements, contact:

Canadian Food Products
Tel: 634 6889 • Fax: 634 9048

FOOD PRODUCTS

Naram's are pioneers in making of Syrup Crush, Sherbat from kesar, badam, dry black currant, apricot, dry fig, mixed dry fruit, plum-peach, chocolate, kokum, thandai from natural and pure material.

Dr. Vidyutt K. Naram, a B.Sc. with Chemistry, has done Craft Diploma in Bakery and Canning from Dadar Catering College in 1982 and also has a Doctorate in Nature Cure from Delhi. The Nature Cure Federation of India was started by Mahatma Gandhi.

Vidyutt's wife Neela Naram, a B.Sc. DMLT and Cookery expert, looks after production. Syrup, Crush, Sauces and Chutney are manufactured by using quality ingredients. Process parameters are carefully controlled and have desired characteristics, quality, suitability, acceptability by people. She has developed authentic Pani Puri Concentrate, Hot and Sweet Chutney, Amla Spread, Picante (Pizza) Sauce, Ginger Spread and Dessert Sauces etc. A special variety are exported to different countries and are also available at leading Dry Fruit shops in Mumbai, Pune, Gujarat and Hyderabad etc.

This quality products are ideal for Milk Shake, Juice Parlour, Desserts, Sweet meat, Bakeries, Caterers, Ice cream Toppings and for daily use.

Recently they have developed Amla Syrup, Tulsi-Honey Ginger, Cola, Chat Chutney and Sugarless Khajoor Pak, Cappuccino Coffee, Apple Kismis, Lime Tea and Dry Fruit Fudge. Quality control is a mantra in the organisation. This has been proved beyond doubt that even a small scale unit can give best quality products made from pure ingredients."

For further details, contact:

Naram's Food Products
Post Box No. 7694
Mumbai 400 067
Tel: 887 3328 / 4035
Fax: 898 1317 / 886 1202

INK CODER

Satish Enterprises offer their services by virtue of their own expertise and innovative designs with a vision for the profitability of Beverages, Food, and Pharmaceuticals Industries.

Indeed they have established "The name of repute" in serving the industries as "Co-Partner" in totality. Their equipment ranges are Rubber Stereos (Cliche'), Coding and Marking Inks, Overprinting Machines, Shipper / CG Box Coder / Online AutoCoder, Hot Ink Rollers for Hot ink coder like Markem® / Kortho®.

Satish Enterprises also imports and resels the Inkjet Inks / Makeup for Coding by CIJ Printer like Videojet®, Domino®, Willet®, Linx®, Imaje® etc.

The salient features are excellent coding and marking results. As on today Satish Enterprises is catalyst in pharmaceuticals, chemical, food and beverages, agrobased and cosmetics industries by supplying to more than 1000 satisfied customers.

For more details, contact:

Satish Enterprises
A-3/62, Janak Puri
New Delhi 58
Tel: 91-011-5516904, 5535353, 5502859
Fax: 91-011-555363
Email: codeprnt@bol.net.in
info@satishenterprises.com
Website: www.satishenterprises.com

SPRAY DRIED GUM ARABIC

Drytech Process (I) Pvt. Ltd, is a One Stop Shop for various kinds of Spray Dried Food Powders, be it Gum Arabic, Fruit / Vegetable / Spice Blends or Caramel. The Company has extended its business horizon from manufacturing of Spray Dried Gum Arabic/Gum Acacia to Fruit and Vegetable Powders including Encapsulated Spice Oleoresins and Caramel Powder. Product ranges includes Gum Arabic (ARAGUM) and Food Powders.

In their fruit powder range are tomato, orange, lime, mango, banana, papaya etc. The encapsulated oleoresin powder range consists of black pepper, capsicum, ginger, garlic, cardamon, paprika etc. In the fat based powder range are groundnut, sunflower, soya, ghee, and sodium and calcium caseinate in the caseinate powder range. To fulfil your diverse requirements, Drytech Processes (I) Pvt. Ltd. manufacture ready-to-use Gum Arabic. Spray Dried Gum Arabic is pure, free from impurities with uniform quality and viscosity. It is free flowing, with low moisture content thus ensuring longer shelf life. It saves on processing time, and cuts power and labour cost.

The unique properties of Spray dried Gum Arabic include emulsifying, stabilising, coating, binding and encapsulating. With the added advantages of adhesivity and calorie control, Gum Arabic is widely used in the manufacture of food flavours, soft drink, confectionery, chewing gum, coated nuts, bakery icing, syrups, diabetic and dietetic foods, asafoetida, medicinal tablets etc.

For your requirements, write to:

Drytech Processes (I) Pvt. Ltd.
B-16 Girikunj Industrial Estate,
Mahakali Caves Road
Andheri (E), Mumbai 400 093
Tel: 8378915, 8326494,8301918,
8210401
Fax: 022-8242476, 8367442
Email: drytech@bom8.vsnl.net.in
Visit us at: www.drytechindia.com

GOOD FOOD

Twenty-five years ago, A.B.C. Farms started out as a small family business on the outskirts of Pune. Today, it has developed over fifty different varieties of cheese including Edam, Gouda, Fondue, Emmental etc. as well as other products such as Lemsi, Ghee, Butter etc. Over the past decade, A.B.C. Farms has been making waves in the restaurant business too, with six speciality restaurants in Pune and two in Goa. These restaurants offer Swiss, Mexican, Thai, Hyderabadi, Japanese, Italian and Indian Cuisine.

A.B.C. Farms has now launched a seven-eight inch 'PEOPLE's PIZZA' for Rs. 20/- only. The tomato puree is offered in two varieties, one absolutely Italian type and the other more spicy in taste. The herbs basil and oregano are also organic and farm grown. They have developed a special low fat pizza cheese for the people's pizza.

For further details, contact:

A.B.C. Farms Pvt. Ltd.
Survey No. 35/36, Koregaon Park
Pune - 1
Tel: 020-6876555
Website: www.abcfarmsindia.com
E-mail: abcfarms@vsnl.com

MILKOPACK

Pack-age systems are manufacturers of low cost packaging machine. The company manufacturers a large variety of Automatic and Semi-automatic Form Fill and Seal machines for solids, liquids and powders.

Milkopack for packing of milk in Poly-Bags having all contact parts of Stainless Steel.

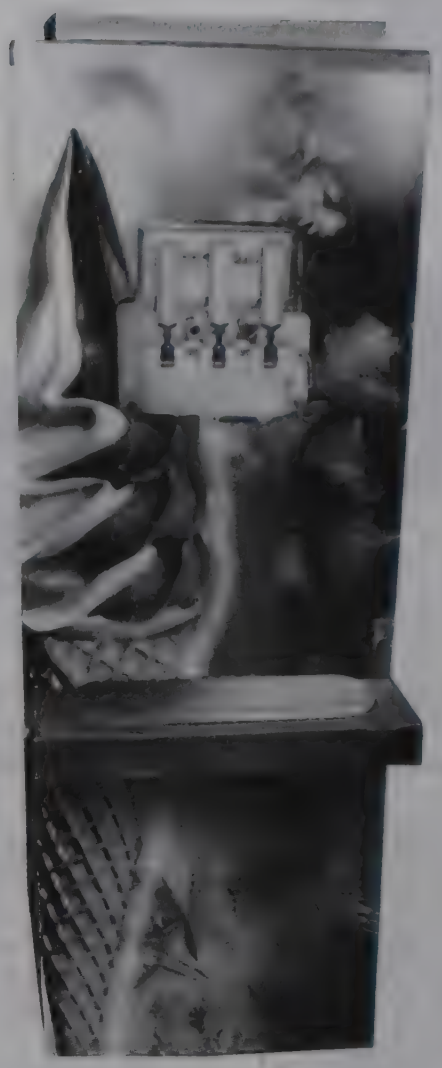
Fill ML/GMS	:	200, 500 & 1000 (Any 2)
SPEED	:	300 to 500 Bags/Hr
SEAL	:	Impluse
SIZE MM	:	900 L x 800 W x 1400 H
POWER	:	230V 1Ph AC 50Hz 600W

The company also manufactures Liquivend, Liquipack, Ultrapack, Panpack, Autopack, Auger/Weigh Auger, Milkopack, Piston Filler, Unipack, Foot Sealer, Auto Sealer Machines.

For further details, contact:

Pack-Age Systems
24, Anant Colony
685/3, Bibvewadi
Pune 411037
Tel: 91-20-6834293
Fax: 4216755
Email: package54@rediffmail.com
Website: www.package-systems.com

SOFT ICE-CREAM MACHINE



SNOWBALL Softee Machines are high technology machines designed to obtain high profits with low operating costs and easy to use and handle. They guarantee a perfect hygiene comparable to international standard machines. Twin flavour soft ice-cream machine.

Notable Features: • Two refrigerated mix tanks of 10 litres each, thermostatically controlled • Stainless steel freezing cylinder with direct expansion refrigerated system • High performance augur type beater • Gear pumps for high and constant ice cream overrun (upto 70% depending on the type of mix used) with fast expulsion • Gravity fed pipes with overrun upto 40% (depending on the type of mix used) • Overnight storage facility, thus saving energy of upto 50% and there by reducing motor and compressor wear and tear • Automatic system to control the ice cream consistency • Total ice cream extraction, thanks to a special piston and front lid assembly • Parts easy to be removed and cleaned even by unskilled operators.

For further details, contact:

Snowball Enterprises
315, M.G. Road
Pune 411 001
Telefax: 020-6852313
Tel: 020-6133288/6114735

VACUUM PACKAGING MACHINE

Packmech Engineers are manufacturers of all stainless steel vacuum packaging machine with gas flushing arrangement to enhance shelf life of perishable food products like Cheese, Paneer, Meat Products, Seafood, Dryfruits, Tea, Coffee, Processed Foods etc without loss of aroma & weight.

The machines are available in Table Top, Trolley Type, Double Chamber & Vertical Model versions to Vacuum Pack products from 50 gms. to 50 kgs. with required output.

Also available POWERVAC-Nitrogen Flushing & Sealing Machine for Pillow Packing of potato & banana wafers, dryfruits etc. to maintain crispness, freshness & to protect them from breakages.

For your requirements, contact:

Packmech Engineers
23/4, Kailash Indl. Estate
B/h. CMC, Odhav
Ahmedabad 382 415
Tel: 287 6181
Telefax: 079-287 6893
Email: powervac@satyam.net.in

THERMAL MINI ANOMETER

TESTO from Germany introduces first Thermal Mini Anometer to measure Air Velocity, Volume Flow and Temperature. Measuring units are selected m/s and m3/h (volume flow calculators 0 to 99,990 m3/h).

This instrument can be used for inside the ducts and at outlets of ducts also Measuring range is 0 to 10 m/s and -20 to 50°C. It works on 3AAA micro batteries and battery life 20 Hm. It also has cut off function.

Application: this instrument can be used for air velocity measurement of ventilation duct, air condition, funnels and version application.

For your requirements, contact:

Waaree Instruments Ltd.
36 Damji Shamji, Indl. Complex
Off. Mahakali Caves Road
Andheri (E), Mumbai 400 093
Tel: 022-8204778
Fax: +91-22-8321273
Email: waaree@waaree.com

PACKAGING MACHINE

TERRA 25 is the latest addition from Bosch, to its reliable range of Vertical form, fill and seal machines. Marketing and engineering inputs drawn from different Bosch centres, have just ensured that, TERRA 25 is a piece of wholesome technology.

Technical specification : • Max. bag size 250mm width x 400mm length • Speed up to 80 cycles/minute • Double film transport with simple belt adjustment • Temperature control integrated in PLC • Designed for co-extruded films and multilayer laminates • Pillow, gussetted and block bottom bags possible • Can work with cupdoser auger, weigher and counter.

TERRA 25 has application in Rice, Pulses, Coffee powder, Spices, Wheat flour with gas flushing for increased shelf life. The machines are affordable and has amazing performance capacity.

For further information, please contact:

Motor Industries Co. Ltd. (MICO)
Packaging Technology Division
Post Box No. 3000
Adugodi, Hosur Road
Bangalore 560 030
Tel: 080-2992032/2033
Fax: 080-2213706/2223546
Email: vtin@in.bosch.com

FRUIT PROCESSING MACHINERIES

Since 30 years M/s. Techno-Equipments has been manufacturing and supplying high quality Fruit Processing Machinery to leading Fruit Processors.

The high quality of the machine as per the specification given is due to the expertise and dedication of Food Technology/Engineering in this field.

All machines are designed and fabricated under the supervision of Senior Technologists and experienced engineers, by maintaining strict quality control from procurement of raw material to the final assmbly under going rigid tests before it leaves the factory.

Techno-Equipments is manufacturing machines like Exhaust-box, Retorts, Steam jackets kettles with/without anchor type stirrers, Fruit Pulpers, Fruit Mills, Juice Extractors, Vacuum Bottle Fillers/Washers, Pineapple Slicers and Papaya Cubers with s.s. Tanks.

For more details, contact:

Techno-Equipments
9, Satyam Industrial Estate
Behind USV Ltd.
Off. B.K. Devashi Marg
Govandi, Mumbai 400 088
Tel: 5515640

FOOD PROCESSING EQUIPMENT

A wide range of machines/equipment are manufactured by Geeta Food Engineering, such as * Steam Jacketted Kettles * Pulper-cum-Finisher * Papaya Cubing Units * Pineapple Slicing Machines * Juice Extractors * Fruit and Vegetable Crushers * Pickle Filling Machines.

Other products manufactured by them are: Bottle washing and filling machines, Exhaust Box, Boiler, SS Top Table & SS Tanks, Vacuum Evaporation Vessels.

For further details, contact:

Geeta Food Engineering
Plot No. C-7/1, TTC Area
Pawana MIDC, Thane-Belapur Road
Behind Savita Chemical
Navi Mumbai 400 705
Tel: 7906450/51, 7610907
Tel/Fax: 7906451

PRECISION FITTINGS

Sri Pump & Fittings is equipped with well planned High-Tech manufacturing facilities like Precision Investment, Casting Process, CNC Machining Centres — under one roof to achieve self-reliance and efficiency.

Specialized in Centrifugal Pumps, Valves and Fittings suitable for aseptic and Hygiene Equipments, catering to Dairy, Beverages & Foods and Pharmaceutical Industries in SMS and DIN Standards.

All the products are tested in-built House facilities like Chemical Testing of Metallurgical Compositions, Hydraulic/ Pneumatic and Pressure Tests, Cycles/ Torque Tests. For Pumps delivery at various head like Amps, Temperature and Vibration Tests.

For further information, please contact:

Sri Pumps & Fittings
Industrial Corporation
D.No. 89-18-45, Morumpudi Junction
Rajahmundry - 533 103
Tel: 0883-426845, 430819
Fax: 0883-430819
Email: sripumps@yahoo.com

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- Poultry
- Fisheries and Sea - food
- Biotechnology
- Food logistics - warehousing, godowns, refrigerated transport, cold storage's, etc.
- Wines, beers and liquors
- Bakery and confectionery including chocolates
- Beverages, tea, coffee and soft drinks
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No. 12A, 1st Floor, Jalan SS12/1B,
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INDIAN
TRADE FAIRS & CONFERENCES

KISAN UTSAV 2001
Venue: Gandhinagar, Gujarat
Date: 31st Oct. - 4th Nov., 2001

Organised by Sumperk Project, Kisan Utsav 2001 (Agro Fair) is a premier National Exhibition on Agriculture products and equipment to be held at Gandhinagar in Gujarat.

Kisan Utsav 2001 offers unique opportunity for producers of Agricultural products, dairy products, Agriculture Machines, Equipment and Technology for farming equipment suppliers, traders to display their products, technology or services in the part of the state.

Participation in this event will help to broaden the customer base. Approximately 3 lakh visitors are expected to visit the fair.

Exhibitor's Profile:

A) Equipment and inputs are: • Fertilizer • Pesticides • Seeds • Agro Chemicals • Tractors • Irrigation equipment and water management • Green House / Flori Culture / Horticulture • Bio Technology • Dairy Products • Food Processing • Cold Storage equipment • Garden Accessories • Bio-Fertilizers • Packing Materials & Equipment • Organic Farming • Tissue Culture.

B) Agro Services: • Research & Development • Agriculture Extension Services • Agricultural credit/Financial institution • Nurseries • Agricultural Co-Operatives of Marketing Agencies • Agro Technology Consultants • Agro Export Services • Transportation, Handling Agencies & Equipment • Agriculture Publication • Cold chain suppliers & Joint ventures • Information Technology

For more details contact:

Sumperk Projects, Shree Sardar Patel Trust, Gandhinagar, C/3, Second Floor, Apana Bazar Building, Sector No. 6, Gandhinagar 382 006. Gujarat Tel: 079-3225728, 3240628, Fax: 079-3230571, Email: Info@sardarkisan-utsav2001.com, Website: www.sardarkisanutsav2001.com

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AHAR 2001
Venue: Ahmedabad
Date: 1-4 November, 2001

'**AHAR 2001**' provides an unique opportunity for fresh, frozen and processed food products, food processing machinery and equipment, refrigeration machinery and equipment, packaging material and machinery requisites for hotel, kitchen and catering equipment, utilities, furniture, decoratives etc.

Exhibitor's profile: • Food Products • Food Processing Machinery and Equipments • Hotel, Restaurants and Catering Products/Equipments • General

For more details contact:

Insite Exhibition Organiser, 18, 1st Floor, Empire Tower, Nr. Associated Petrol Pump, C.G. Road, Ahmedabad 380006. Tel: 079-6449837, 6562080, Fax: 079-6449301, Email: ahar2001@ insite-exhibition.com, Website: www. insite-exhibition.com

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BANGALORE AGRI FOOD 2001
Venue: Bangalore
Date: 1st-5th Dec., 2001

Organised by Wisitex Foundation in association with the government of Karnataka, Bangalore Agri Food 2001 will provide unique platform to technology producers and potential investors to forge industrial and business partnership on a sustainable basis. The exhibition has 3 distinct segments that will make the show technology oriented, market relevant and business specific for all thrust areas of this Mega Event.

International exhibition will be a platform to display finished products, machinery, systems, packaging, plants, raw materials and also to meet joint venture partners. It will enable local and international business alliance, effect technology transfer and boost export-import tie ups.

International seminars will enable world leaders to interact and discuss on trade, technologies update, laws, policy frame work etc.

Corporate presentation will directly focus on latest technological developments in Agri and Food Industry products and systems offered

For more details contact:

Ms Ritu Nehra, Camp Office No 88, Jeerige Building, 3rd Floor, 11th Cross, Malleswaram, Bangalore 560 003. Tel/ Fax: 080-346 1598, Email: mukesh 177-us@yahoo.com

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FOODPRO 2001
Venue: Chennai
Date: 8-11 December, 2001

Organised by Confederation of Indian Industry (CII) **FOODPRO 2001** – India's flagship & premier Food Business Event is a comprehensive business fair featuring a 4-Day International Exhibition & Conference on Food Industry, and will highlight and showcase the tremendous opportunities across the entire Agricultures, Food and Dairy Chain.

FoodPro 2001 – The Highlights: • 4-Day International Exhibition • Conferences & Investment Seminars • Technical Sessions & Technology Forums • Parallel Events & Food Festivals • Exclusive State Government Pavilion • 150+Exhibitors.

FoodPro 2001 – Opening Markets: Market opportunities across the entire

Agri/Food chain by way of Investments, Joint Ventures, Technology Transfers with Indian Companies or Exporting to India for • Modernisation of the Food Chain • Agri-Inputs (High Yielding Seeds, Processing Varieties) • Agriculture (Farming Techniques, Inputs, Basic Mechanism) • Procurement & Storage (Material Handling, Packaging, Cold Chains, Transportation, Grading Systems) • Processing (Large Scale Facilities, Processing and Packaging Machinery & Technologies) • Retailing (Cold Chains, Retail Outlets) • Exports of Food & Agricultural Products including Processed & Packaged Foods.

The **FoodPro 2001** Exhibition will attract all the players in the Agriculture, Food, Dairy Businesses from all over India including Food Processors, Rètail Chains, Hotel & Restaurants, Importers who would be using the Exhibition as a forum to source new Technologies, Equipments, Packaged & Processed Food and Dairy Products as well as fresh agro producers.

Exhibition Profile: Technologies, Equipments & Systems: Food Processing Equipment, Preservation Systems, Refrigeration Technology, Packaging Systems, Beverages, Processed Frozen Foods, Dairy Equipment & Technology, Dairy Products, Poultry Equipment and Technology, Poultry Products, Automation & Control Systems for Food Processing Equipments, Printing & Packaging, Storage and Handling Asceptic Facilities.

Food Products: Processed & Frozen Foods, Packaged Foods, Beverages – Tea, Coffee, Alcoholic & Non-Alcoholic Beverages. Dairy Products – Milk, Butter, Ice Cream, Cheese, etc., Horticulture Products.

FoodPro 2001 Conferences: CII will be organising a host of International Seminars and Conferences in areas such as bio-technology, water manangement, food processing, livestock, cold chain technologies, IT & agriculture, agri-infrastructure, agro-packaging, WTO & agriculture and food laws.

For more details contact:

Confederation of Indian Industry Business Fairs Division, 35/1, Abiramapuram, 3rd Street, Alwarpet, Chennai 600018. Tel: 0091-044-4987648, 466 0571/0291/0773, Fax: 0091-044-4660312, Email: j.shanker@ciionline.org / v.kuppuswamy@ciionline.org

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AGRI EXPO 2002
Venue: Paldi, Ahmedabad
Date: 3-6 January, 2002

Agri Expo 2002 will showcase the products and services focused at the most important element of the region's economy, the farmer.

It will provide an excellent platform to manufacturers and distributors of agricultural inputs to showcase their products and services and to interact with one of the most enterprising, progressive, and prosperous farmer communities of the country.

Leading lights in the fields of Agriculture, including agroforestry and animal-husbandry, and also the agro-machinery industry as well as companies providing agricultural inputs like fertilizers, pesticides, insecticides will participate in the exposition.

Main Objectives of Agri Expo 2002: • Developing the market for technocrats and manufacturer of various raw materials used in agriculture by interaction with farmers • To understand the problems of farmers in cultivating and solve accordingly • Providing the practical education to the farmers • Updating the Indian economy • Providing A Super market of Agriculture inputs to the farmers.

Agri Expo 2002 will attract more than 100,000 farmers from all over Gujarat.

For more details contact:

Garima Communication, 12, Kajal Kiran, Srimali Society, Opp. Jain Derasar, Navrangpura, Ahmedabad 380 009. Tel: 644 6186, 640 0900, Fax: 079-642 3108.

INTERNATIONAL
FOODTEC INDIA 2001
Venue: Chennai Trade Centre
Date: 9-12 February, 2002

Confederation of Indian Food Trade and Industry (CIFTI) was set up by FICCI in 1985, to cater specifically to the needs of Food Industry and Trade. Today, it is the apex body of food industry in the country providing institutional support to food trade, hotel industry and processed food industries manufacturing almost all types of food and allied products including the affiliated sectors like packaging, machinery, seed development etc.

CIFTI is the only Indian Sponsor and the organization of the event International FoodTec India 2002 in India and will be directly co-ordinated by CIDEX, the Indian, subsidiary of Köln Messe International and Messe Düsseldorf, a joint venture initiative.

The fair will be organized concurrently with INDPACK 2002 International and INDPRINT 2002 International, India's most renowned packaging and printing fairs focussing on Packaging Materials, Auxiliary Materials, Packaging Products & Components, Packaging Machinery, Converting Machinery, Printing and Allied Machines, Labelling and Coding Systems etc. which also has a huge role to play in the food processing sector.

CIFTI will also organize technical seminars on topical issues during the event, which will be addressed by the experts from the field including industry, government and research organisations and also the international speakers representing the participating companies. There will be a special Indian Processed Food Pavillion.

The exhibition's focus will be to present the latest developments and trends in the fields such as: • Processing Technology • Packaging Technology • Ingredients like aromas, enzymes, extracts, food preservatives, fruit products, powders, concentrates, starter cultures • Logistics / Production Transportation • Measuring and Regulation Systems • Analytics.

For more details contact:

Confederation of Indian Food Trade and Industry, Federation House, Tansen Marg, New Delhi 110 001. Tel: 011-3736305, 3738760 – 70 (11 lines), Fax: 011- 3320714 / 3721504, Email: ciftinfo @vsnl.net, Website: http://www.foodtechindia.com

KISAN AGRICULTURAL TRADE FAIR

Venue: Bangalore
18-21 October, 2001

KISAN 2001 – Indian Agricultural Trade Fair, to be held from 18th October – 21st October 2001 at Palace Grounds, Bangalore. The farmers of Southern India is the focus at KISAN. KISAN offers him an overall perspective as well as updating in the latest products, services, research and development, trade news and the business opportunities in Agriculture.

KISAN '01 is the eighth event in the successful KISAN series and third at Bangalore. It has always remained the Largest Agri show contemporarily. On the background of WTO and no Quantitative Restrictions, every one in the Agriculture Industry should be alert, keen to meet and deliberate on key issues in the agriculture industry. KISAN is one such effective platform which promotes innovative concepts and technological advances among the Indian farmers which will help him compete with the world and capture the Market.

The KISAN exhibition will cover an expanse of 30,000 sq.m. consisting of 7 covered pavilions with a separate section for open display of agricultural machinery. The event will have special display pavilions like Krishi Vikas – Agri Inputs, Krishi Udyog – Agri Business Krishi Mitra – Hall for Small Enterprise Biotek – Biotechnology, Gram Vikas – Hall for Rural Development and KISAN Manch – Conference Hall.

The display spectrum would include Seeds & Planting Material, Fertilizers, Pesticides, Irrigation Systems, Agricultural Equipment & Machinery, Farm Implements and Tools, Green House & Accessories, Bio Technology, Research & Development, Rural Development, Information Technology and Organic Farming.

KISAN 2001 shall draw over 1 lakh farmers and Agri professionals from 4 states of southern India. These include farmers from all over Southern India, agriculturists, decision makers from key government organisations, agricultural institutions, research organisations and financial institutions. Each and every visitor at KISAN 2001 shall be registered, which will help compile in formation on emerging trends in cultivation practices, cropping patterns and changing needs of the farmers.

The event is being organised by Deccan Exhibitions Pvt. Ltd. and supported by Key organisations in the Government and Agriculture Industry. Support and participation of Agricultural and Processed Foods Export Development Authority (APEDA) New Delhi, Directorate of Horticulture, Karnataka Agro Industries Corporation, Karnataka Agricultural Marketing Board, Directorate of Animal Husbandry and Veterinary Sciences, National Dairy Development Board and HOPCOMS will highlight development policies and schemes of Central and State government. Specific to their profile of the agriculture industry.

An educational and scientific information will be available at KISAN 2001 due to the active participation and support of the educational and research institutions such as the University of Agricultural Sciences in Bangalore and Dharwad, Central Food Technological Research Institute, Mysore a premier research organisation in Food Science and Technology among others.

Some of the key highlights at KISAN 2001 include, Gram Vikas – a special Pavilion on Rural Development will be a unique forum and meet for the gram panchayats from the solution states of India to work towards ideas on rural development. It will serve as a forum for exchange of ideas and resources among Sarpanch, Teachers, Health Officers, NGO's and self help groups working on rural development who will gather here.

A workshop on rural development for the gram panchayats and over 200 self help groups is proposed to be organised by the Department of Rural Development, Government of Tamilnadu concurrent to KISAN 01.

Large plot of 200+sq.m. has been reserved in the centre of the fair for live demonstration of all types of machinery, equipment, gadgets etc. Farmers will get opportunity to operate these equipment's on their own. This live performance would explain the efficacy and economy of machinery in use.

KISAN Forum will host Product Presentations or Launches at KISAN. The manufacturers will also use this forum to interact with Farmers and understand their needs. The discussions and deliberations held here will create awareness about the technological advances in the agriculture industry.

For more details contact:

CONVENOR – KISAN 2001
57/2, 11th Main Road
Malleshwaram
Bangalore 560003
Tel: 080-3316330
Email: bhavani@kisan.com
Website: www.kisan.com

KISAN 2001

Bangalore
18th – 21st
October 2001

LIST OF PARTICIPANTS

(as on September 18, 2001)

AASHIRWAD PIPES PVT.LTD.
No.4-B, Attibele Industrial Area, Hosur Road, Bangalore - 562107
Tel: 080-20271, 20542, 20543
Exec: Pawan Poddar (Mng. Dir.)

ADIKE PATRIKE
Bhat Building, P.B.No.29, Yelmudi - Puttur
Tel: 574201 • Fax: 08251-21240

AG BIOTECH
202,Sriniketan Apartments Plot No. - 37 A.S.Raju Nagar, Behind Royal Mansion, Kukatpally, Hyderabad - 72
Tel: 3063997 • Mobile: 98480-25050
Email: agbiotek@yahoo.com
Exec: Veira Reddy (Dir.)

AGMARK
1st Floor, M.G.Complex, A.P.M.C. Yard, Bangalore - 560022
Tel: 080-3473004
Exec: Dr. Sajni Kumar (Sr. Mktg. Off.)

AGRI GOLD FARMS
40-1-21/21,4th Floor, Catholic Complex, M. G. Road, Vijaywada - 10
Tel: 0866-491754 • Tel/Fax: 0866-483711
Email: agrigold@md4.vsnl.net.in
Exec: A.H.S.V. Prasad (Exec. Dir.)

AGRICULTURE AND INDUSTRY SURVEY
C-2.286, 4th Main,2-C Cross, Domlur, 2nd Stage,3rd Phase, Bangalore 560071
Tel: 5294536

AGRICULTURE AND PROCESSED FOODS EXPORT DEVELOPMENT AUTHORITY
12/1 , Palace Cross Road, - Bangalore
Tel: 560020, 3343425, 3364560

AQUASUB ENGINEERING
A-92, KSSIDC Industrial Estate, Rajajinagar, Bangalore 560044
Tel: 080-3381891
Exec: Ragotham Kulkarni (Br. Mgr.)

ATLANTIC PRINTS
A-349, Meera Bagh, New Delhi - 110 087
Tel: 011-5263264, 5283264
Exec: Shri Amar Pal Singh (Director)

AVENTIS CROP SCIENCE
Shreshta Bhumi, Block No. 206, 207, No. 87, 2nd Flr., K.R. Rd., Bangalore 560004
Tel: 080-6514070, 6521944, 6521947
Fax: 080-6793720
Email: natekar_madhav@hotmail.com
Exec: Dr. Madhav Matekar (Mktg. Head)

BAJAJ TEMPO
Mumbai - Pune Rd., Akurdi, Pune - 411035
Tel: 020-7476381 • Fax: 020-7473017
Email: sacharya@tempoindia.com
Exec: Sushen Acharya (Sr. Mgr. - Mktg.)

BEJO SHEETAL SEEDS PRIVATE
A-3, Old MIDC, Jalna - 431203
Tel: 02482-32588/36588
Fax: 02482-30398
Email: bejosheetal@hotmail.com
Exec: Shivkumar Baijal (Mgr. - Mktg.)

BEVERAGE AND FOOD WORLD
Narang House, 41, Ambalal Doshi Marg, Mumbai - 400001
Tel: 022-2650268, 2654184
Fax: 022-2641275
Email: dasilva@vsnl.com
Exec: Norman da Silva

BHINGE BROTHERS
W-62, MIDC, Satpur, Nasik -
Tel: 0253-351181, 351481
Fax: 0253-362581
Email: bhinge@vsnl.com
Exec: Naren Bhinge (Dir.)

CFTRI
Mysore - 570013
Tel: 0821-514534
Fax: 0821-515453
Email: ttm@cscftri.ren.nic.in
Exec: Dr. T.R.Prabhu (Head - Technology Transfer and Business Development

CENTRAL INSTITUTE FOR AGRICULTURAL ENGINEERING
Regional Centre - Industrial Extension Project, Coimbatore 641003
Tel/Fax: 0422-434276
Email: ciaeiep@kovai.tn.nic.in
Exec: S.J.K. Annamalai (Principal Scientist and Head)

CENTRAL INSITITUTE FOR RESEARCH ON COTTON TECHNOLOGY
Post Bag No. 16640, Adenwala Road, Matunga, Mumbai - 400019
Tel: 022-4127273 • Fax: 022-4130835
Email: paralikarkishor@hotmail.com
Exec: Dr. K. M. Paralikar (Principal Scientist & Head, Transfer of Technology)

CENTRAL WAREHOUSING CORPORATION
9-Mission Road, Bangalore - 560027
Tel: 2222231, 2233111, 2216885
Email: cwcblr@kar.nic.in
Exec: C.T.Thomas (Regional Mgr.)

CENTRE FOR PROCESSED FOODS
NO.804, 17TH 'E' MAIN, 5TH BLOCK, Rajajinagar, Bangalore 560010
Tel: 3352796
Email: cpf@vsnl.com
Exec: Chetan Hanchate (Senior Manager)

CHEMM EXPORTS
Municipal Office Road, P.B. 111, Kerala
Tirchur - 680 001
Tel: 0487-440014
Exec: Sebastian George (Director)

DEPARTMENT OF RURAL DEVELOPMENT & PANCHAYAT RAJ, TAMILNADU
Panagal Building, 1 Jeenis Road, Saidapet - Chennai 600015
Tel: 044-4321126 • Fax: 044-4350043
Exec: Rajashekharan (Additional Dir.)

DEPARTMENT OF RURAL DEVELOPMENT & PANCHAYAT RAJ, KARNATAKA
M.S. Bldg., Vidhana Veedhi - Bangalore 560001
Tel: 2265478, 2265478
Fax: 5711765
Exec: B.S. Hiremath (Joint Dir. – Planning)

DEPARTMENT OF SERICULTURE
Multistoreyed Building, Dr. Ambekar Veedhi - Bangalore 560001
Tel: 2253856, 2268429
Email: sericom@vsnl.com

DIRECTORATE OF AGRICULTURE
Sheshadri Road - Bangalore 560001
Tel: 2212804, 2212688
Exec: Dr. S.Subramaniam Commissioner

DIRECTORATE OF HORTICULTURE
Lalbagh - Bangalore 560004
Tel: 6613391
Exec: Dr. R.Jayaprakash (Joint Dir. – CMT)

DIRECTORATE OF HORTICULTURE & PLANTATION CROPS
Agriculture Complex, Chepauk, Chennai-600005
Tel: 8524643 • Fax: 8524643
Email: dirhorti@md4.vsnl.net.in
Exec: Surjit Chaudhary (Commissioner - Horticulture & Plantation Crops)

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Rajendra Nagar - Hyderabad 500030
Tel: 040-4013109
Fax: 040-4013111, 4015800
Email: pdrice@ap.nic.in
Exec: B.Mishra (Project Director)

EICHER TRACTORS
220,Richmond Towers, 12, Richmond Road, Bangalore - 650 025
Tel: 2232102, 2294149 • Fax: 080-2279129
Email: harishkumar@eicher.co.in
Website: www.eicherworld.com
Exec: Harish kumar (Dy. Mgr.)

FLORENCE FLORA
9/3/2, Bimanna Garden, 4th Cross, Laxmi Road, Shanthinagar, Bangalore - 560027
Tel: 080-2233208, 2294064 / 4065, 2239560
Email: florasia@usa.net
Exec: S.K. Gutgutia (Dir.)

FORETELL CAPITAL TRUST (P) LTD.
3530, 13th H Main,1st Cross Road, HAL 2nd Stage - Bangalore 560008
Tel: 080-5276152
Fax: 080-5276153, 080-5276154
Email: commodityindia@vsnl.com
Website: www.commodityindia.com

GINEGAR PLASTICS
V-3, Mayflower Apartments, Flat no. 6, 3rd flr., 4th Main Rd., Annanagar, Chennai 641 040

Tel: 044-6215212, 4750548 (off.) 6215212
Email: rajeeb@vsnl.com
Exec: Rajeeb Roy

GOLDEN SEEDS PRIVATE LIMITED
B-22,Block,Brigade-MM Buildings, K.R. Road Cross,Yediyur, Bangalore - 560082
Tel: 6766764/6762212
Email: goldenbl@styam.net.in
Exec: Dr. N.N. Raghvendra Rao (Dir)

GREAVES
16/3, Ali Asker Road, Bangalore 560052
Tel: 080-2262062, 2262501, 2253472

GROWMORE
41-B, SIPCOT, Phase II, Hosur - 635 109
Tel: 91-4344-60564, 60565
Email: growmore@vsnl.com
Website: www.growmorebiotech.com
Exec: Ms. N.Barathi (Dir.)

HARDIKAR'S FRUIT PROCESSING PVT. LTD.
13, Himalaya , Lane No.3, Dhanukar Colony, Kothrud, Pune - 411029
Tel/Fax: 020-5442435
Email: mangofun@pn3.vsnl.net.in
Exec: Ms. Jayshree Dhupkar (Dir.- Mktg.)

HITECH
Kamala Mansion, Ground Floor, 143, Infantry Road, Bangalore - 560001
Tel: 080-2869788, 2863122
Fax: 2863122

HONDA
61/63,1st Floor, 27th Cross, 8th Main Road, 4th Block, Jayanagar, Bangalore 560 011
Tel: 6646004, 6347825
Email: ao.bir@hondasielpower.com
Website: www.hondasielpower.com
Exec: K.C.Reddy (Area Mgr.)

HOPCOMS
Lalbagh, - Bangalore 560 004
Tel: 6578404, 6572195
Fax: 080-6578017
Exec: T.H. Kempegowda

INDO AMERICAN HYBRID SEEDS
Post Box. No. 7099, 17th Cross, 2nd A main, K.R.Road, Banashnakari, 2nd Stage, Bangalore - 560070
Tel: 080-6760111, 6761479
Email: drram.ho@indamseeds.com
Website: www.indamseeds.com
Exec: Dr. Anil Ram (Vice. Pres., Mktg.)

INTERNATIONAL AGRO SEEDS
No.28, ^th Main Road, Sajjan Lodge Building, Gandhinagar, Bangalore - 560009
Tel: 080-2268046/080-2285228
Fax: 080-6523649
Exec: D.N.Mallikarjuna

INTERNATIONAL DEVELOPMENT ENTERPRISE
B-2, Kingsway Apartments, No.15, Kings Street, Richmond Rd., Bangalore 560025
Tel: 080-2244070
Fax: 080-2279392
Email: ide@giasbg01.vsnl.net.in
Website: www.ide-india.org

ISRA AGROTECH SYSTEMS PVT. LTD.
S-79, GCDA Complex, Marine Drive, Cochin - 682031
Tel: 0484-350933
Fax: 0484-364345
Email: israagro@sancharnet.in
Exec: Dr. Jacob Thomas (C.E.O.)

JAIN IRRIGATIONS SYSTEMS PRIVATE LIMITED
Jain Plastic Park , Bambhori, P.O. Box 72 Jalgaon - 425001
Tel: 0257-250011/22
Email: agricul@bom6.vsnl.net.in
Exec: R.J.Patil (Prod. Mgr.)

JANGAN TRADING CO.
626, 2nd Main, 1st Stage, Indiranagar, Bangalore - 560038
Tel: 5271528, 5213111 • Fax: 5280505
Email: jtilban@bgl.vsnl.net.in
Exec: Thomas Mathew (Dir.)

JAYASHREE DIES AND COMPONENTS
22-B, Revabhai Estate, NH-8, C.T.M., Ahmedabad - 380026
Tel: 079-5857851, 5857827, 5857382
Email: jayendraswami@epatra.com
Exec: Jayendra C. Patel (Ptr.)

JOHNSON FILTERATION SYSTEMS (INDIA) LIMITED
5-B, Rashmio Society, Mithakhali Circle Navarangpura, Ahmedabad - 380009
Tel: 02764-81220/21, 81440
Fax: 02764-81028
Email: sales@johnsonscneensindia.com
Exec: Ravindra Gosain (Asst. Mgr. Sales)

KSB PUMPS
KSB PumpsLtd, Mumbai - Pune Road, Pimpri, Pune - 411018
Tel: 020-7472008, 7470990
Fax: 7476120
Website: www.kbsgroup.com
Exec: Shekhar Karale (Officer - Mktg.)

K.M. ENTERPRISES
23/24, Rajdeep Society, Opp.Income Tax Off., Naupada, Thane (W), Thane 400602
Tel: 022-5426785
Fax: 022-5426769
Email: uwi@vsnl.com
Website: www.thanawalagroup.com
Exec: Muffadal Thanawala

KAMAT RESTAURANT
KAMAT Yatrinvas, Gandhinagar, Bangalore - 560009
Tel: 080-2260088
Fax: 080-2281070, 8380211
Mobile: 98440-18452
Email: kamat@blr.vsnl.net.in

KARNATAKA AGRO CHEMICALS
No.180, 1st Main Road, Mahalami Layout Extension, Bangalore - 560086
Tel: 3497464, 3494406
Fax: 3497360
Email: kacbng@blr.vsnl.net.in
Website: www.multiplexgroup.com
Exec: Mahesh Shetty (Dir.)

KARNATAKA AGRO INDUSTRIES CORPORATION
Karnataka Agro Industries Corporation Hebbal, Bangalore 560024
Tel: 3415371
(Dir.): 341 2923, 341 2839
Exec: Dr.T.V. Reddy

KARNATAKA STATE AGRICULTURAL MARKETING BOARD
16, 11th Cross, Rajbhavan Road, Bangalore
Tel: 2867192, 2867128
Fax: 2864532
Exec: H.Parashuramappa (Deputy Gen. Mgr. – Mktg.)

KAT INDUSTRIAL CONSULTANTS PVT. LTD
World Trade Centre (38, Ground Floor), Barakhamba Lane, Babar Road, Connaught Place, New Delhi - 110001
Tel: 011-3413183, 3942632, 3411360, 3939959
Fax: 011-3413183
Email: katcon@del2.vsnl.net.in
Exec: Arun K. Gupta (Director)

MAHENDRA ENGINEERING
151,Auto Towers, J.C. Rd., Bangalore 560002
Tel: 080-2233223, 2237109
Email: maheeblr@eth.net
Exec: Manoj Kumar (Br. Mgr.)

MALMO EXIM
Door no.17, ACME Estate, Sewree East Mumbai - 400015
Tel: 022-4131111, 22415111
Fax: 022-4135719
Email: malmo@vsnl.com
Exec: Ahmed Shariff (Sales Exec.)

MARUTI FERTOCHEM
Sidharth Arcade, Station Road, Aurangabad - 431005
Tel: 0240-354912
Fax: 0240-332111
Website: www.rjgroupcomanies.com
Exec: S. P. Shirsikar (Gen. Mgr- Mktg.)

MEGHA AGROTECH
14/1, 1st floor, M M lane, SJP Road Cross Bangalore - 560002
Tel: 080-2271490/2231012
Fax: 080-2271490
Email: prasadalur@hotmail.com

MINILEC (INDIA) PVT. LTD.
1073/1-2-3 /at Post Pirangoot, Tal. Mulshi Pune - 412111
Tel: 02139-22355-57
Fax: 02139-22134
Email: minilecgroup@vsnl.com
Exec: A. S. Pathak (Asst. Mgr. Mktg.)

MITTAL MUSLI FARM & RESEARCH CENTRE
Above Old Telephone Exchange, Main Road, Jalgaon Jamod - 443402
Tel: 07266-21550
Fax: 07266-21572
Email: info@safedmuslifarm.com
Website: www.safedmulsifarm.com
Exec: G. D. Mittal (Mng. Ptr.)

NABARD
National Bank for Agriculture and Rural Development, Jeevan Praksh Annexe, 113/1, J.C. Road, Bangalore 560002
Tel: 2225241, 2223125
Fax: 2222148
Email: ndbbng@bgl.vsnl.net.in
Exec: Narayan Patil

NAMDHARI SEEDS PVT. LTD.
Uragahalli, Bidadi - 562109
Tel: 08113-82401/2/3/4
Fax: 080-8602168
Email: butasingh@namdhariseeds.com
Exec: Buta Singh Kanwal (Dir. - Mktg.)

NANDAN AGRO FARMS
301, Sneha Enclave, Srinagar Colony Hyderabad - 500073
Tel: 040-3738084/040-3738261
Fax: 98490-26651/98480 32799
Email: jayakumar@nandanagrofarms.com
Website: www.nandanagrofarms.com

NATIONAL DAIRY DEVELOPMENT BOARD
P.B. No.9506, 8th Block, 80 ft Road, Koramangala - Bangalore 560095
Tel: 5711183, 5711391
P.A. No.5710401
Fax: 5711168
Email: ksm@bang.nddb.ernet.in
Exec: J. S. Prakash (State Director)

NATIONAL DAIRY DEVELOPMENT BOARD
579/D, Subbiah Circle, Chamraja Mohalla, Mysore 570004
Tel: 0821-333306
Exec: J.S. Prakash

NATIONAL DAIRY RESEARCH INSTITUTE
Hosur Road, Adugodi - Bangalore 560030
Tel: 080-5710662
Exec: Mrs. M.C.A. Devi (Extension - Head)

NATIONAL HORTICULTURE BOARD
First Floor, M.G. Complex, APMC Yard Yeshwanthpur - Bangalore 560022
Tel: 3371935
Email: nhb-blr@kar.nic.in
Exec: Ms. Meena (Asst. Dir.)

NATURE LIFE SCIENCES
Madhav Apts, Shridhar Nagar, Chinchwad, Pune - 411033
Tel: 020-7456461
Fax: 020-7450966
Email: NLSPL@vsnl.net
Website: www.nspl.com
Exec: Jitendra Kulkarni (CEO)

NAVEENA VELLANMAI
17, Aziz Mulk Road, First Floor, Thousand Lights, Chennai 600006
Tel: 8292979
Fax: 044-8254745
Email: vellanmai@intamm.com

NETLON INDIA
No. 8, 1st floor, 1st 'B' Cross, Sudhamanagar, Lalbagh Rd., Cross, Bangalore - 560027
Tel: 91-80-2229054
Fax: 91-80-2270270
Exec: Kaushik C. S. (Supervisor – sales)

PADMA INDUSTRIAL CORPORATION
17/1,H.K.K. Lane, S.P. Road Cross Bangalore - 560002
Tel: 2226942, 2275264

PIONEER AGRITECHNOSCAN
Savitri Smriti, Flat 11, 2nd Flr., Prabhat Road, Erandwane, Pune - 411004
Tel: 020-262413, 262415
Email: pioneer@ip.etn.net
Website: www.pioneer@ip.etn.net
Exec: Dr. T. T. Patil (Mng. Dir.)

PLANTSMAN SEEDS
Rajabha Road, Near Red Cross Bhavan Patiala - 147001
Tel: 0175-21295
Fax: 0175-303951
Email: plantsman@glide.net.in
Website: www.plantsman.com
Exec: Abdul Wahid (Mng. Dir.)

POPULAR STEEL WORKS
1325/1K/1 Shivaji Udyamnagar, Kolhapur - 416008
Tel: 0231-657376/663435
Fax: 0231-657988/657221
Email: psw@vsnl.com
Website: www.popularpsw.com
Exec: Rajendra Keshav Rao Jadhav (Mng. Dir.)

PRINCE MUTLIPLAST LIMITED
1309, Brindavan Layout, Kavallbyrasandra, R.T.Nagar, Bangalore - 560032
Tel: 080-3332303, 3533042, 3332303
Exec: Raji Sam (Mktg. Mgr.)

PROMPT. SUBMERSIBLE SYSTEMS
SF.no - 359, Site no-5 Tirichy road, Singanallur, Coimbatore - 641005
Tel: 0422-590968 • Fax: 0422-576168
Email: Promtartesia@satyam.com
Website: www.promptsubmersibles.com

RATNAGIRI IMPEX
43/23, Promenade Road, 2nd Cross, Frazer Town, Bangalore - 560005
Tel: 080-5305301, 5368210
Email: info@ratnagiriimpex.com
Website: www.ratnagiriimpex.com
Exec: Rohit Patre (Mng. Dir.)

RURAL INNOVATIONS NETWORKS
No.19, Conran Smith Rd., Above Annapoorni Hotel, Gopalapuram, Chennai 600086
Tel: 044-8239420
Email: rinovations@yahoo.co.in
Exec: K. Sharath (Project Mgr.)

S. KUMARS AGRO HORTI CONSULTANCY
Plot.No. 704, D.No. 8-2-268, A-2, Road No.3, Banjara Hills, Hyderabad - 500034
Tel: 040-658810, 3745312
Email: oskreddy@england.com
Exec: O.S.K. Reddy (Prop.)

SATRAC ENGINEERING PRIVATE LIMITED
Dodadanna Industrial Estate, Peenya Stage, Bangalore - 560091
Tel: 080-8362601, 8361214
Fax: 080-8360554
Email: sales@satrac.com
Website: www.satrac.com
Exec: M.C. Bantwal (Dir.)

SHANTHA ENGINEERING
No.10, Anusaya, Opposite to Mangala High School, Kopri, Thane (E) - 400603
Tel: 022-5406281, 5339288
Fax: 022-5430605
Exec: S.R.Rege (Mgr. - Mktg.)

SIEMENS INDIA
No. 84, Kenonics Electronics City, Hosur Road, Bangalore - 561 229
Tel: 8521188, 6697747
Fax: 8521180/81

SNOWLINE HVAC SYSTEMS PVT. LTD.
Suryakiran, 20, Shree Niketan Society 128/2, Kothrud, Pune - 411029
Tel: 020-5444771, 4002885
Fax: 020-4002886
Email: snowline@giaspn01.vsnl.net.in
Website: www.snowline-hvac.com
Exec: Bipin B. Patil (Mng. Dir.)

SOMAIYA ORGANO CHEMICALS LTD.
Warden House, 3rd Floor, Sir P. M. Road, Fort, Mumbai - 400001
Tel: 022-2885635, 2870773
Fax: 2884636
Email: bhumilabh@somaiya.com
Website: www.somaiya.com
Exec: Hrituraj Choudhary (Asst. Mgr.)

SRIHARI ENTERPRISES
Shrihari Enterprises, Varale Rd., Talegaon Dabhade (Stn), Tal. Maval, Pune 410 507
Tel: 02114-26433
Tel/Fax: 02114-24406
Email: shriharienterprises@vsnl.com
Website: www.shriharienterprises.com
Exec: Vishwas Jogdand (Ptr.)

STANPACK
515, "GORONTLA NILAYAM" 10TH 'B' Main Rd., 1st block, Jayanagar, Bangalore 560 011
Tel: 6562095, 6562038, 6568348
Fax: 91-80-6568348
Email: muralidhar@blisssgroup.com
Website: www.blissgroup.com
Exec: Rtn. G. Muralidhar (Dir.)

SUPREME INDUSTRIES
No.24,Pamadi Towers,19, 1st Main Road, Gandhinagar, Bangalore - 560008
Tel: 080-2285475/080-2285657
Fax: 080-2204697
Email: pavankumar_gupta@supreme.co.in
Exec: Pavan Kumar Gupta (Reg. Mgr.)

SURESH FORESTRY NETWORK
P.B. No.15, Chikkballapur, Chikkballapur - 562101
Tel: 08156-73361/08156-62028
Fax: 08156-73361
Email: bamboo9@rediffmail.com
Exec: K.M.Suresh (Exec. Dir.)

TRANASIA INTERNATIONAL
138, 1st Floor, Auto Towers, 39, J.C.Road Bangalore - 560002
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Fax: 080-2241459
Email: harikv@vsnl.com
Exec: K.V.Hari

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Krishi Nagar - Dharwad 580005
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Fax: 091-0836-44349
Exec: Dr. Nadagoudar (Dir.)

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Email: aris@uasblr.kar.nic.in
Exec: Dr. B.S. Siddaramaiah

VAARTHA
#30/1, Leemans Complex, 6thFloor, Cunningham Road - Bangalore 560052
Tel: 2289707 • Fax: 2289708

VARDHAMAN SEEDS & FERTILIZERS
Pratibha Tower, 4th Floor, 18A/2-B, Pune Mumbai Rd., Wakdewadi, Pune - 411005
Tel: 020-5810898, 5814978
Exec: Ravikant Shah (Mng. Dir.)

VARSHA AGRO INDUSTRIES
61/C, Chikkakalla Sandra Village, Subramanyapura Post, Bangalore 560061
Tel: 080-6690280 • Fax: 080-6693394
Exec: Venkatesh Rao (Ptr.)

VELKAN INDUSTRIES
33 Krishnanagar, Indl Area, Hosur Road Bangalore - 560029
Tel: 080-5536481, 6686296
Fax: 080-6636772
Email: velkan@vsnl.com
Exec: Mrs. J.Mendonza (Prop.)

WARM STREAM
Annad Sojitra Road, P.O.Box-22, Udyognagar, Anand, Gujurat - 388121
Tel: 02692-31316/32309/36478
Email: warmstream@gnahd.global.net.in
Exec: D.J.Bulsara

INTERNATIONAL
TRADE FAIRS & CONFERENCES

FOOD TECHNOLOGY EXPO 2001
MEATEX & FROZENEX 2001
CEREAL & OIL CHINA 2001
Venue: China
Date: 21-24 November, 2001

Food Technology Expo, will be held from November 21-24, 2001 at Xiamen International Conference & Exhibition Centre, Fujian, China. Incorporating two specialized events namely The 2nd International Meat and Frozen Processing & Packaging Equipment & Products Exhibition for China (Meatex and Frozenex 2001) and The 2nd International Exhibition on Cereal, Oil and Foodstuff Processing, Storage and Transportation Technology for China (Cereal & Oil China 2001), Food Technology Expo is geared to be the largest specialist exhibition of its kind in the South China.

Food Technology Expo is a show dedicated to the China's food industry, containing all up-to-the-minute machinery and technologies from food manufacturing, processing, packaging, to ingredients, additives and end-products. The expo is expected to have over 2000-buyers and senior executives from every corner of China, including food manufacturers, processors, packagers, developers, engineers, quality control specialists, consultants, traders, etc.

Food Technology Expo offers an excellent opportunity for overseas investors to penetrate the lucrative China market.

For more details contact:

Unit 1223, 12/F, HITEC, 1 Trademark Drive, Kowloon Bay, Hong Kong, Tel: 852-2865 2633, Fax: 852-2866 1770, 2865 5513, Email: enquiry@bitf.com.hk

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INTERNATIONAL ORGANIC TRADE FAIR
Venue: Tokyo, Japan
Date: 13-15 December, 2001

Under the patronage of the International Federation of Organic Agriculture Movements (IFOAM), BioFach Japan opens its doors to the International organic market.

BioFach Japn – International Organic Trade Fair is organized by Nürberg Global Fairs and Japanese media concern and exhibition organizer Nihon Keizai Shimbun Inc.

The target groups on the exhibitor side are mainly producers and dealers of organic products, and the trade visitors comprise wholesalers and retailers, importers, buyers from department store chains and convenience stores, experts from food processing, catering and the hotel trade, and farmers who would like to convert to organic farming.

For more details contact:

Mr. Frank Venjakols, Project Manager – BioFach Japan. Tel: 49 (0) 911 8606-697, Fax: 49 (0) 911 8606-694, Email: info@nuernbergglobalfairs.com, Website: nuernbergglobalfair.com

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HONG KONG INTERNATIONAL FOOD FAIR
Venue: Hong Kong
Date: 24-27 January, 2002

Hong Kong International Food Fair, organized by Neway International Trade Fairs Ltd., will make its debut from Jan 24-27, 2002 at the Hong Kong Convention & Exhibition Centre. This premier event will provide a superb opportunity for local and overseas manufacturers, suppliers, agents, distributors and franchisers to get in touch with potential buyers and business partners from Hong Kong and all over the world. The fair will be the best place to explore new markets, exchange ideas as well as promote new and existing brands.

Widely recognised as the "Gourmet's Paradise", Hong Kong is the only place where the most diversified and finest Western and Oriental food are found. Located at the centre of Asia, Hong Kong has always been the perfect location for trade and business development for the food industry. Hong Kong is also a major distribution centre in Asia and China.

The market trend of the food industry is becoming more diversified these days. The forthcoming food fair will respond to these changes in the market by featuring new products in different Thematic Zones. Highlights will include the "Green Food", "Health Food" and "Sweets & Bakery" Zones etc. Over 15,000 quality visitors from Hong Kong, China and different parts of the world will attend The Hong Kong International Food Fair.

For more details contact:

Neway International Trade Fairs Ltd., 9/F, Fortis Tower 77, Gloucester Road, Hong Kong. Tel: 852-2561-5566, Fax: 852-2811-9156, Email: info@neway-fairs.com, Website: http//www.neway-fairs.com

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BIOFACH
Venue: Nürnberg, Germany
Date: 14-17 February, 2002

BioFach 2001 saw the euphoric mood over the extraordinary rise in demand for organic products. The next opportunity to get information about international range of organic food and natural products will be BioFach 2002 at the exhibition centre in Nüremberg from 14th-17th February, 2002. The country of the year will be Spain which will present attractive products and its culture. Over 1725 exhibitors are expected to take part and more than 25,000 trade visitors are expected.

For more details contact:

Indo German Chamber of Commerce, Maker Tower, E, 1st Floor, Cuffe Parade, Mumbai 400 005. Tel: 2186131 / 2186118, Fax: 218 0523, Email: ruby@indo-german.com

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HOTERES JAPAN 2002
FOODEX JAPAN 2002
Venue: Tokyo
Date: 12-15 March, 2002

Foodex Japan 2002, the 27th International Food and Beverage trade show, will be held at Nippon Convention Center

from March 12 to 15, 2002. Foodex Japan enjoys the reputation of being the No. 1 event in the Asia Pacific Rim. Foodex Japan provides essential business opportunities to penetrate the vast Asian market and for business expansion in Asia.

Hoteres Japan, which runs concurrently with Foodex Japan, is Asia's largest equipment, systems, and services exhibition for the hospitality industry. And for Hoteres Japan 2002, the 30th International Hotel & Restaurant Show, some 80,000 visitors are expected to attend the show.

For more details contact:

The Secretariat of Hoteres Japan / Foodex Japn, Japan Management Association, Convention Div., 3-1-22 Shiba-koen, Minato-ku, Tokyo 105-8522, Tel: 81-3-3434-3453, Fax: 81-3-3334-8076, Email: convention@hoteres.jma.or.jp, concention@foodex.jma.or.jp

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PETPOINT
Venue: Germany
Date: 23-27 April, 2002

The first International Exhibition PET point for PET bottles closures crates and filling equipment will be held at Essen from 23rd – 27th April, 2002. This exhibition will run parallel toMET PACK and coinside with INTERPACK.

The Production of PET bottles follows a process which closely links manufacturers around the world.

PET point's group stands are dedicated to recycling, dairy products, and special solutions in preforms, bottle design, closures, and labels.

The first world congress for PET is conceived as a promotion device for PET as well as the chance to exchange views and experience. Competent experts will deal with relevant topics such as technology and marketing.

Until now the suppliers of these various pieces of equipment were to be found at some widely differing exhibitions, with there being no central forum for the PET industry. At PET point we now intend to fill that gap, and present PET packaging in all its varied aspects will be showcased. Large and small suppliers from around the world will be getting together to show their products at the first exhibition of its kind.

Exhibition Profile: • Materials for bottle and cap production • Packaging components and accessories • Raw materials for beverage production • Preform production • Bottle production • Cap and crate production • Ancillary equipment for the production of preforms, caps and crates • Moulds • Materials and accessories for moulds • Bottle handling and preparation • Beverage preparation • Filling machines • Labellers and capping machines • Downstream equipment • Recycling • Laboratory equipment • PET concultancy and support services

• Contract manufacturers.

For more details contact:

PET planetPUBLISHER GmbH, Haus Isenburg, 58566, Kierspe. Tel: +49-2359-2996-0, Fax: +49-2359-2996-10, Email: brangenberg@petpla.net

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INTERPACK 2002
Venue: Düsseldorf
Date: 24-30 April, 2002

The 16th International Trade Fair for Packaging Machinery, Packaging and Confectionery Machinery is attracting international exhibitors to the Düsseldorf Trade Fair Centre.

International trade visitors will find companies from the packaging sectors – such as the confectionery industry, the pharmaceutical and cosmetic industries, and manufacturers of technical consumer goods. These are set to unveil new, flexible packaging solutions and complete services. Interpack offers tailor-made solutions for all market needs: Exhitors will showcase custom concepts, from modern packaging materials to all-in, sophisticated packaging solutions. There will be an extensive array of exhibits from production technology for the confectionery industry, including complete information on the product manufacturing process, including packaged end-products.

For more details contact:

Press Office Interpack 2002, Florence Radon / Ramona Müller. Tel: +49 (0) 211 / 4560-464 / 598, Fax: +49 (0) 211 / 4560-8548, Email: radonf@messe-duesseldorf.de, muelleerra@messe-duesseldorf.de

BUYERS' GUIDE

A.B.C. FARMS PVT. LTD., S.No. 35/36, Koregaon Park, Pune 1. Tel: 6876555, Website: www.abcfarms india.com, Email: abcfarms@ vsnl.com
Products: * Food Products like varieties of Cheese * Lemsi * Ghee * Butter * Pizza

ACE HYGIENE PRODUCTS PVT. LTD., 222, Shah & Nahar (A2), Lower Parel, Mumbai 13. Tel: 494 5957 / 495 4190, Fax: (022) 495 4250, Email: ho@alfa-india.com, Website: www.alfauv.com
Products: * Water Purifiers

AGUAPURO EQUIPMENTS, 2/22, Panwala Building, Dr. S.S. Rao Rd., Lalbaug, Mumbai 400012. Tel: 4101432/415 5576, Fax: (022) 415 5576, Mobile: 9821078929, Email: ID aguapuro@vsnl.com, Website: www.aquapuro.s5.com
Products: * Dosing Equipment * Multimedia Sand / Carbon Filters * Softeners / Demineralisation Systems * Reverse Osmosis Systems * Micron Filters * Ozonators * Turnkey Project for Mineral / Pure Water for f&b application

ALOK INTERNATIONAL, 406, Goradia House,100/104 Kazi Sayed Street, P.O. Box 13048, Mumbai 400003. Tel: 342 6390/ 3415668. Fax: 91-22-341 5668
Products: * Gum Algel * Gum Tragacanth * Gum Karaya * Gum Ghatti * Gum Ester * Gum Guar * Gum Arabic/Acacia * Agar Agar * Locust Beand Gum * Gum Carrageenan etc.

APEX ELECTROMEC PHARMA P. LTD., 16, Nitin Indl. Complex, Ghartan Area #1, S.P. Road, Vaishali Nagar, Dahisar (E), Mumbai 400 068. Tel: 8964096 / Telefax: 8960263, Fax: 8968615. Email: apexppl@hotmail.com. Website: www.apexelectro-mec. com
Products: * Automatic/Semi automatic powder/Granule Fillers * Filling Line Accessories * Infrared Ray Dryers * Material Handling Equipments

AQUA FILSEP INC, 7, Retiwala Industrial Estate, H.A. Palav Marg, Byculla (E), Mumbai- 400027. Tel (O): 3719455 (R): 4465521, Fax 91-22-4465521. Ahmedabad: A1/ 1, Chinubhai Towers, Above IOB, Opp. Handloom House, Ashram Road, Ahmedabad 380009. Telefax: 079-6580047/6584069, Email: filsep@ad1.vsnl.net.in, Website: www. aquafilsep.com
Products: * Water & Effluent Treatment Plants * Softners * Demineralisers * Reverse Osmosis Plants * ETP * Chemicals

ARTIC INDIA SALES, 20, Rajpur Road, Delhi 110054, Tel: 3912800, Fax: 011-29470751, Email: aisdelhi@pahwa.com
Products: Manufacturers of Bry-Air, Dehumidifiers

ASHISH CHEESE PRODUCTS, 363/2 Villa Sultanpur, Mehrauli Gurgaon Rd., New Delhi 110030. Tel: 680 2713, 651 6586, Mobile: 9810100973, Email: rp-mehta@ hotmail.com
Products: * Cheese Products

BOMBAY INDUSTRIAL ENGINEERS, 13, Crystal Apts., Gulmohar Cross Road 11, JVPD, Mumbai 400049. Tel: 91-22-6232810/6201914, Fax: 6201914 Email: ijsehgal @bom5.vsnl.in
Products: * Food Processing Machinery such as * Pulpers * Juice Extractors * Steam Jacketed Kettles * Fruit Slicers/Crushers * Mango Cutter * Canning Retorts, Hot/Cold Liquid Filling Lines * Bottle Closing Powder Filling, Form-Fill-Sealing Machines * Dryers (Tray, Tunnel, Drum, Fluid Bed) * Biscuit/ Bread Making Machinery * Toffee-Hard Boiled Sweet Machinery * Chewing Gum Making Machinery * Ovens * Sigma Kneaders * Mixers

CANTECH MACHINES, 13, Vora Bhuwan, Maheshwari Udyan, Above Dena Bank, Matunga (C.Rly.), Mumbai 400019. Tel: 91-22-4096086, 4096853, Fax: 409 6086, Email: dpandya@bom3. vsnl.net.in
Products: * Can Seaming, Reforming, Flanging, Embossing, Testing Equipment and Body Beader of International Standard. Complete Fruit & Vegetable Canning Project on Turnkey Basis. Available Imported High Speed Can Seamers both New and Second Hand Machines and OTS Aluminium Two Piece Canline can be procurred * Liquid Fillers * Metal Box Machines Spares

CHHAYA ENTERPRISES, C-5, Parle Colony, Sahar Road, Vile Parle (E), Mumbai 400057. Tel: (F): 8329259, 8205584
Products: * F& B Processing Machinery e.g. * Colloid Mill * Volumetric Filler * Lobe Pumps * Syringes * Machinery Spare Parts

COSYWO™ ENGINEERING COMPANY, 15 Laxmi Co-op. Indl. Est., Near Nagarvel, Hanuman Mandir, Amraiwadi Rd., Ahmedabad -26. Telefax: 2748164, 2748001, Website: www.cosywo.com
Products: * Stirrers(Lab. & Tank Mounted) * Telescopic Stand with geared agitator * Emulsifier * S.S. Tank * Hollow Shaft Drum Stirrer

CREATIVE CONCEPTS, F-60, Sector 8, Noida 201301, U.P. Telefax: 011-4523339, 4552249, 4543337, Email: concept@nda. vsnl.net.in / subodhbhatnagar @vsnl.com
Products : Ozone generators for sterilization of Air, Water and Food * Water Treatment Plants * Mineral Water Plants

DR. TK FOOD CONSULTANTS PVT. LTD., 312E, Crystal Plaza, Lokhandwala Link Road, Andheri (W), Mumbai 400053. Tel: 022-6346889/90, Fax: 022-634 9048, Email: kuchroo@bom3. vsnl.net.in, Website: www.drtkfood. com
Products: * Pasta Plant and Equipment * Dairy Plant * Snack Food and Farsan * Snack Foods Ingredients * Packaging Machine

DRYTECH PROCESSES (I) PVT. LTD., B-16, Girikunj Industrial Estate, Mahakali Caves Rd., Andheri (East), Mumbai 400 093. Tel: 8378915, 8326494, 8301918, 8210401, Fax: 022-8367442, 8242476, Email: drytech@ bom8.vsnl.net.in, Website: drytechindia.com
Products: * Spray Dried Food Ingredient such as * Gum Arabic

kaizen@zeenext.com
Products: * Weigh-Fill Machine

KAMANI OIL INDUSTRIES, 317 Puran Asha Building, Narsi Natha Street, Mumbai 400 069. Tel: 343 5968, Fax: 3435964, Email: kamani@bom2.vsnl.net.in
Products: * Refined Vegetables Oils

KOMAL INDUSTRIES, 108 Creative Ind. Centre, 12 N.M. Joshi Marg, Lower Parel, Mumbai 400011. Tel: 91-22-3091090, 3091174, Fax: 3062711, Email: kcc@giasbm01.vsnl.net.in
Products: * Water Treatment Plant * Water Demineralisation Plant * Mineral Water * U.V. Disinfector * Drinking Water System * Micron Filter * Ozonator * Water Softening Plant * RO Systems *Water Filteration Plant * Water Purifier * Dosing System

KRITI INDUSTRIES (INDIA) LTD., Chetak Chamber, 4th Flr., 14 R.N.T. Marg, Indore. Tel: 731-704716/7/8, Fax: 731 704506
Products: * S.W.R. Pipe and fittings (ISO 9002 Company)

KUMAR PROCESS CONSULTANTS & CHEMICALS PVT. LTD., 230/4, Ashoka House, Behind Sheetal Arch, Linking Road, Bandra (W). Mumbai 400050. Tel: 91-22-6451964, 6432512, 6420637, Fax: 91-22-6432512, 6420637, 6451964, Email: kumarfil@bom3.vsnl.net.in
Products: * Polishing Filters for Solvents, Aqueous Solutions, Injectables * Membrane Holders * Liquid Filters upto 0.1 Micron * Air Filters upto 0.01 Micron * In-Line Conical Filters Micron *S. S. Lab Filters * Filter Cartridges & Discs * Filter Housings

LAB INSTRUMENTS, 9, Ratnadeep, 78-B, Jagannath Sankar Seth Road, Mumbai 400004. Tel: 3690973, 3681316, Fax: 3690973
Products: * Laboratory Equipment & Appliances e.g. * Spectrophotometer * Electronic Balances * Ion Analyser * Tintometer * Brook Field Viscometer * Centrifuge * pH Meter * Conductivity Meter * Polarimeter * Refractometer * Stirrers * Emulsifiers * Hot Air Ovens * Heating Mantles * Filter Paper * Borosil Glassware * B.O.D. Incubator * Moisture Meter

LITHOTECH ENGINEERS, Sector 10, B-25, S-2 Shantinagar, Mira Road (E), Thane 401107. Tel: 8110182, 8113648, 8113617, Telefax: (95250) 392410, Email: lithotech@vsnl.com
Products: * Masala Mill - Grinding * Chillies * Turmeric * Coriander * Mix Masala * Dehydrated Onions * Garlic * Ayurvedic * Other products

LUCAS ELECTRONICS, B2/5, Mapkhan Nagar, Near fire Brigade, Marol Naka, Andheri (E), Mumbai 400059. Tel: 821 3660, Telefax: 8501265, Email: lucasg@bom2. vsnl.net.in
Products: * Continuous Sealer Machine with Gas Flushing Machine * Shrink Wrapping Machine * Cap Sealer Machine * Vacuum + Nitrogen Flushing Machine * Motorised Pepsi Sealer Machine * Mineral Water Pouch Sealing Machine

M. SON INDUSTRIES, D-33, Sector-2, Noida 201 301, U.P. Telefax: 011-8-4552177, 453 8397 (R) 011-8-453 6955, 454 3199, Email: mson@nda.vsnl.net.in, Website: www.food.machines.com
Products: * Roasting Plants * Ready To Eat Snack Plant * Conveyorised Roasters & Driers * All Types of Mixers & Pulverisers * Potato Peeler * Steam Jacket Kettle * Steam Retard * S.S. Storage Tanks * Crown Corking Machines * Rotary Roasters * Dal Driers * Papad Plant * All Types of Extruders * All Types of Conveyors for Material Handling * Chappati Making Plant

MALHAR INDUSTRIAL ASSOCIATES, Regd. Office: B-3, Harish Ind. Compound, Royal College Road, Penkar Pada, Mira Road (East), Dist. Thane 401104. Tel: 6902332, Fax: 8100348, Email: malharsweets@vsnl.net
Products: * Indian Sweet Meat manufacturing machines.

MERITT TRANSMISSIONS, 157/159, Narayan Dhuru Street, Behind Nagdevi Street, Mumbai 400003. Tel: 3444956,3442857, 3428342, Fax: 91-22-3414107,4078268, Email: merittransmissions@vsnl.com, Website: merittransmissions.com
Products: *ISO 9002 Certified Roller Chains * Sprocket and Precision Chain under brand name 'Rainbow'.

MEVISH ENGINEERING WORKS, Hill View Apartments, C-402, Marol Military Road, Andheri, Mumbai 400 059. Tel: 8504375, 8574376
Products : Filteration pumps, Centrifugal, Monoblock pump * Rotary Gear Pump * Gear Pump * Lobe pump * Liquid Filling machines * Turn Table

MICRON ENGINEERING GROUP, 1063 Bhandup Industrial Estate, Pannalal Silk Mill Compound, L.B.S. Marg, Bhandup (W), Mumbai 400 078. Tel: 561 8278/580 5416, Fax: 568 1470, Email: micronhomogeniser@hotmail.com
Products: * Filling Sealing Machines for vicous/liquid products * Homogeniser for Dairy and Beverages * Rotary Indexing type filling & sealing machines * Crate washer * High pressure pumps

MOTOR INDUSTRIES CO. LTD., Post Box No. 3000, Adujodi, Hosur Road, Bangalore 560 030. Tel: 080-2992032/2033, Fax: 080-2213706, 2223546, Email: vtin@in.bosch.com
Products: * Vertical Form Fill and Seal Machines

NARAM'S FOOD PRODUCTS, Post Bag 7694, Mumbai 400 067, Tel: 887 4035/3328, Fax: 886 1202
Products: * VINIDA'S brand Chutney * Sauces * Sugarless Health Sweets * Chinese Sauces * Dr. NARAM'S brand Syrups * Sharbats * Crush *Concentrates

NEEL BIOTECH PVT. LTD., S/3, Navrang, Swastik Cross Road, Navrangpura, Ahmedabad 380009. Tel: 91-79-642 6971, 656 8012, Fax: 656 2199, Email: nbo@dewang.com / dcorp@vsnl.com
Products: * Food Processing Machinery * All Equipment Comply with HACCP Standards

NEW INDO INTERNATIONAL, 135-A, Begumpur, Malviya Nagar, New Delhi 110 017. Tel: 6685315, 6687476, 6683289 (R): 6514224, Fax: 6688290
Products: Food Processing and Packing Machines

NIMACH ENGINEERING CO, (Manufacturer & Exporter) 6, Rajani Estate, Opp Gujarat Bottling, Rakhial, Ahmedabad 380 026. Telefax: 079-2743083
Products: 'Nimach' brand fully automatic high speed label code printing machine Type AU1 * Carton Printer Machine Type AU2

NOVA FLAVOURS & FRAGRANCES (P.) LTD., 301 Sterling Estate, 3rd Floor, Plot No. 8, Ramchandra Lane Extn., Kachpada, Malad (W) Tel: 844 6405, 8446481, Tel/Fax: 8812059, Email: hopl@bom5. vsnl.net.in
Products: * Flavours (Liquid &

Powder * Emulsions and Pastes *Culinary Essences * Essential Oils

P. M. VORA & CO., Ramesh Chamber, First Floor, 14 Garibdas Street, Vadgadi, Mumbai 400003. Tel: 3438487, Telefax: 3445367, Email: hopl@bom5.vsnl.net.in
Products: * Food Flavours & Colours * Food Chemicals * Citric Acid * Soya Lecithin

PACMECH ENGINEERS, 23/4, Kailash Ind. Estate, B/h, CMC, Odhav, Ahmedabad 382415. Tel: 079-2876181, Telefax: 079-2876893, Email: powervac@ satyam.net.in
Products: * Stainless Steel Vacuum Packaging Machine with Gas Flushing * Nitrogen Flushing Machine * Sealing Machine

PARKSAN FILTERS P. LTD., 3, Saraswati Industrial Estate, Navghar, Vasai Road (E), Dist. Thane 401 210. Tel: 0250-391413, 390818, Fax: 8995838, Telefax: 335818, Email: parksan@bom5. vsnl.net.in, Website: www. parksanfilters.com
Products: * S.S. Filtration and Process Equipment for Pharma-ceuticals, Chemicals, Foods & Beverages and Breweries Industries

PRABHAHARI EXIM PVT. LTD., B-3, Nirmal Indl. Estate, Next to V.V.F. Ltd., Sion (E), Mumbai-400022. Tel: 22-4091833/3210, Fax: 22-4082703, Email: pfarma@bom8. vsnl.net.in
Products: * Foodgrade Che-micals * Flavours * Essential Oils * Aromatic Chemicals

PRAJ INDUSTRIES LTD., Praj House, Bavdhan, Pune 411021. Tel: (outstation)+91-2139-51511, 52214, Fax: +91-2139-51718, 51515, Email: ethc@praj.net, Website: http:// www.praj.net
Products: * **ECOFLUX** corrugated Tube Heat Exchangers are specially designed to meet the hygienic requirement in fruit processing applications

PRINCE MULTIPLAST PVT.LTD., Amar House, Plot No. 103, Road No. 12, MIDC Andheri (W), Mumbai 93. Tel: 8363600/01/02/03, Fax:022 -8360404/0088 Email: sales@princemulti plast.com Website: www.princemultiplast. com
Products: * Crates & Blow Moulded Containers

PROCESS MASTERS, S-97, M.I.D.C. Bhosari, Pune 411 026. Tel: 020-7123448, Fax: 020-7110022, Email: pmaster@vsnl. com
Products: * Food Processing Equipment

R&D ENGINEERS, A-41, IDA Kukatpally, Phase -II, Road No.4, Via I.E., Gandhi Nagar, Hyderabad - 500 037. Tel: 3079121, 3079878, Fax: 040-3078668, Email:randengg@hd1.vsnl. net.in, Website: www.rnd wafers.com
Products: * Automatic/Semi Automatic Baking Machine Cream Wafer Biscuit & Icecream Cone making Machine

R.G. GLASS INDUSTRIES, 11-B, Petwalla Compound, 244, Maulana Azad Road (North), Opp. Urdu Times, Near Nagpada Junction, Mumbai 400008. Tel: 3072326, 3086984, 3099896, 3096218, Fax: 91-22-3010223, Email: rgglass@ vsnl.com
Products: * Empty Soda Aerated Water/Soft Drink Bottles * Plastic & Wooden Crates * Empty New Glass Bottles in White, Amber & Green

RAKIRO BIOTECH, Unit-1, New Modella Indl Estate, Behind Automatic Electric Co., Padwal Nagar, Wagle Estate, Thane - 400 604, Tel : 5836846, Fax: 5651808
Products: * Bactaslyde (Easy-to-use Bacteria Testing Devices) * Aquasol - Testing Devices for Chemical Parameters of Water

RIECO INDUSTRIES LTD., 1162/2, Shivajinagar, Behind Observatory, Pune 411005. Tel: 020-553 5384 / 5215, Fax: 020-5533229. Email: rieco@vsnl.com, package @rieco.com
Products: * Size Reduction Equipment * Material Handling System:- * Ribbon Blender * Pneumatic conveying system * Screw conveyor * Fumes & Dust Extraction System * Gas Cleaning System and Air Pollution Control System * Industrial Fan, Scrubber/Absorber/Heat Exchanger * Valves *Packaging Machines * Weighing * Bagging Machines, All Metal Detector & Separator, Tube Filling & Sealing, Liquid Filling Machines

S. A. PHARMACHEM PVT. LTD., 220 Udyog Bhavan, Sonawala Road, Goregaon (E), Mumbai 400063. Fax: (022) 8769532. Tel: 8764700, Email: sac@sachemicals.com, Website: http:// www.sachemicals. com
Products: * Speciality Ingredients

ST. JOSEPH ENGINEERING WORKS, 304 A, Manish Commercial Centre, 3rd Floor, 216 a, Dr. Annie Besant Road, Worli, Mumbai 400 025. Tel: 493 2653/4930792, Fax: 4930792
Products: 'Philips' brand Packaging Machine * Mechanical Weighing Scales * Electronic Weighing Systems * Lorry Weigh bridges

SADANAND APPROTECH PVT. LTD., Regd. Office: B-34, Mini Nagar, S.N. Dube Road, Dahisar (East), Mumbai 400 068. Tel: 811 4536/8104143, Fax: 91-22-8100348, Email: sadanandfoodmachine@rediffmail.com
Products: * Indian Snack food & Namkeen Processing Equipment

SARVAIYA CHEMICALS INDUSTRIES PVT. LTD., Plot No. 2928-2/ 2930-1, 2929/2935-B, J-Type Area, GIDC, Vapi 396195, Dist. Bulbar, Gujarat. Tel: 0260-424941/427941. **Regd. Off.:** C-3, Delite Palace, 1st Flr., M.G. Road, Ghatkopar (W), Mumbai 400086. Tel: 5114968, 5128114, Fax: 514 8450/515 7529, Email: sarvaiya@ bom5.vsnl.net.in, Website: www. sarvaiya. com
Products: * Aqueous Extracts of Agriculture, Vegetable, Plants, Spice based Raw Materials and Liquid, Solutions of Food Grade Chemicals

SATELLITE PLASTIC INDUSTRIES, 2-A2 Court Chambers, 35, New Marine Lines, Mumbai 400 020. Tel: 022-200 6477 (5 lines), Fax: 200 6556, Email:sales@satelliteindia.com
Products: * Pasta making Machines from Italy

SATISH ENTERPRISES, A-3/62, Janak Puri, New Delhi -58. Tel: 011-5516904, 553 5353, 5502859, Email: codapmt@bol.net.in Website www.satishenterprises. com, Fax: 555 3563
Products: * Hot Ink Rollers * Coding and Marking

Machines * Rubber Stereos (Clinche) * Coding and Marking Inks * Shipper, CG Box Coder, Online Autocoder * Compatible Injet Inks.

SAUDAMINI TRANSFORMERS (P) LTD., 15, Vishnu Garden, Najaf Road, New Delhi 110059. Tel: 91-011-5640804, Fax: 011-5643217
Products: * Automatic Voltage Stabiliser * Special Power Transformer * High frequency chokes and switches * Isolation transformers * Transformers manufactured as per client's specifications

SAURABH ENGINEERS, 11, Upvan Co.op. Hsg. Soc. Ltd., Off. 132 Ft Ring Road, Ahmedabad 51. Tel: (O. & R.) 6765115, 6760292, Email:indvac@ ad1.vsnl.net.in, Website: www.indvac.com Fax: 91-79-6765115/2740288
Products: * Packaging Machinery * Vacuum Packaging Machines * Nitrogen Flushing Machine * Shrink Wrapping Machines * Special Pneumatic long Sealers * Continuous Sealers *Vertical Sealers* Impulse/Hotbar Sealers

SAYAJI SETHNESS LTD., 17/18, GVMM, Odhav, Ahmedabad 382410. Tel: 079-2876000/5100, Fax: 2871338 Email:ssi@maizeproducts.com, Website: www.maizeproducts. com
Products: * Caramel Colour

SHIRSAT ELECTRONICS, 133, Dewan Ind. Estate, 6, Navghar, Vasai (East), Thane 401210. Tel: 91-250-392946, Fax: 390793, Email: sakav @vsnl.com
Products: * Dryers * Bakery Ovens * Dehydrators * Fryers * Furnaces * Conveyor Systems

SHRIYAN ENTERPRISES, B/5, Ghanshyam Industrial Estate, Veera Desai Road, Andheri (West), Mumbai 400 053. Tel: 636 9057/636 8328, Tele/Fax: 022-636 8320, Email: shriflow @vsnl.com
Products: Carbonated/Non-Carbonated Packaging Machinery * Volumetric Liquid Filling Machine * Multi Head Rotary Gravity Filling Machine * Premix/Carbonator * Rinsing machine

SNOWBALL ENTERPRISES, 315, M.G. Road, Pune 411 001. Telefax: 020-6852313, Tel: 020-6133288/6114735
Products: * Ice Cream Machines

SOOFI TRADERS, 1317, Dalamal Tower, 211 Nariman Point, Mumbai 400 021. Tel: 2043044, 2825559, 2833074, Fax: 022-2047657, 2845778, Email: soofi@vsnl.com
Products: * Triacetin * D'Limonene * L. Carvone * Span 60 * Tween80 * Saponon Powder (Food Grade) * Fatty Acid (Caproic, Caprylic, Capric) * N-Decanol, Lauryl)

SPANPAK SYSTEMS, B-136, Ghatkopar Indl. Estate, Off L.B.S. Marg, Ghatkopar (West), Mumbai 400086. Tel: 5007184, 5007144, Fax: 5008352, Email: spanpak.filling@axcess.net.in
Products: * Induction Sealing Machines * Volumetric Liquid Filling Machine * Drum Filling Machine * Digital Piston Filler * Capping Machine, Conveyors

SRI PUMPS & FITTINGS INDUSTRIAL CORPORATION, 89-18-45, Morampudi Road, Hindustan Compound, Rajahmundry 533 103 (A.P.). Tel: 0883-426845, 430819, Fax: 430819, Email: sripumps@yahoo.com
Products: * Stainless Steel 304/316 Grade Dairy Fittings * Pneumatic Valves of SMS, DIN Standards * Centrifugal Pumps from 1HP to 7.5 HP of SMS, DIN standards * Pipe Fittings

SUNJAY TECHNOLOGIES PVT. LTD, B-11/12, Bhiwandiwalla Terrace, Gr. Flr. 618, J.S.S. Road, Mumbai 400 002. Tel: 201 6490, 201 5859, 200 4908, Fax: 91-22-2065334, Email: sscorp@vsnl.com, Website: www.sanjayscorp. com
Products: * Analytical Instruments such as Spectrophotomer, Gas Chromatograph, Viscometer, Tintometer, Colorimeter * Analytical Balances * Syringes * Valves

SUPER CARE INDUSTRIES, (Engineers & Consultants), 404A, Kirti Shikhar Building, District Centre, Janakpuri, New Delhi 110 058. Tel: 011-5557732
Products: * Water Treatment Plants * DM Plants * RO Systems * Softeners * Mineral Water Plants * Filtration Plants * Pasteurizers * Bottle Washing Machines * SS Storage Tanks * Sugar Syrup making Machine (Steam & Electrical * Oil Reactors)

SUPERIOR ENGINEERING WORKS, Unit No. 53-B, Shukla Compound, Near Murbali Talao, Shiv Vallabh Road, Dahisar (E), Mumbai 400068. Tel: 91-22-887 8683/2303, Fax: 91-22-8938352
Products: * Slat Conveyor Chain & Wheel

TECHNO AQUATREAT PVT. LTD., 2G Basement Church Compound, Sukhdev Vihar, New Delhi 110 025. Tel: 011-6917749, 6917283 (R): 6235461, Email: technoaqua@satyam.net.in
Products: Package and Industrial type Softeners for hard water

TECHNOVATION ANALYTICAL INSTRUMENTS PVT. LTD., 204, Deccan Court, 259, S.V. Road, Bandra (W), Mumbai 400 050. Tel: 643 1585, 641 3288, Fax: 640 2640, 645 8870, Email: taipl@vsnl.com, Website: technovationindia.com
Products: * Gas Analysers

THE PALANI GROUP OF COMPANIES, 207, Oberoi Trade Centre, Oberoi Complex, Off. Malad Link Road, Near Laxmi Industrial Estate, Andheri (W), Mumbai 400 053. Tel: 6330974/0976/0973, Fax: 6325871/7941, 6361604 Email: palani@bom3. vsnl.net.in Website: www.palani group.com
Products: Dehydrated Vegetables * Guar Gum * Tamarind * Psyllium * Seeds and Spices * Genu Pectin * Genulacta Carrageenan * Blanose Gum CMC * Benecel * Aquasorb * Locust Bean Gum (LBG) * Tara Bean Gum * Agar-Agar *Xanthan Gum * Flour Improvers * Bread * Cake and Biscuit Improvers

UMA BROTHERS, C-110, Bhaveshwar Plaza, 189, L.B.S. Marg, Ghatkopar (W), Mumbai - 400 086. Phone: 5004579, 5004510, Fax: 091-22-5000015. Email: umabros@vsnl.net.in
Products: * Essential Oils * Herbal Chemicals * Food Chemicals * Aromatic Chemicals * Amino Acids * Bakery & Confectionery Chemicals * Dairy Chemicals * Emulsifiers

VASHIST IMPEX, Gaumukh Bhavan, 2nd Floor, 18 Masjid Bunder Road, Mumbai 400 009. Tel: 3778830, Telefax: 3736445, Email: vashist1@vsnl.com
Products: * Aromatic Chemical Flavours and Fragrances * Protein Hydrolysates * Papain

WRAPTECH MACHINES PVT. LTD., Dharamchand Industrial Estate, Deonar Village Road, Mumbai-88. Tel: 5512138, 558 3596, Tel/Fax: 5570726, Email: abm@wrapmachines.com, Website: www.wrapmachines.com
Products: * Full Automatic PLC based Vertical form Fill Seal Machines

BOOKS FOR SALE

S.No.	Description	Publisher	Price
1.	Modern Technology of Food Processing & Agro based Industries	National Institute of Industrial Research	Rs. 800/-
2.	Modern Technology of Milk Processing & Dairy Products	— " —	Rs. 575/-
3.	Modern Technology of Agro Processing & Agricultural Waste Products	— " —	Rs. 600/-
4.	Handbook of Agro based Industries	— " —	Rs. 995/-
5.	Manufacture of Food & Beverages	— " —	Rs. 1295/-
6.	Cereal Food Technology (With Project Profiles)	— " —	Rs. 1295/-
7.	Detailed Project Profiles on Dairy & Dairy Products	— " —	Rs. 795/-
8.	Herbal Cosmetic And Aryuvedic Medicines (EOU)	— " —	Rs. 600/-
9.	Hand Book on Herbal Products (Cosmetics, Medicines, Perfumes & Toiletries) - 2 Volumes	— " —	Rs. 1500/-
10.	Herbs Cultivation & Medicinal Uses	— " —	Rs. 750/-
11.	Modern Technology of Perfumes Flavours & Essential Oils	— " —	Rs. 850/-
12.	World Wide Importers Register (Int'l Buyers Directory) - 2 Vols.	— " —	Rs. 2250/-
13.	Directory of Foreign Buyers & Exporter (With Email & Fax Nos.)	— " —	Rs. 675/-
14.	Hand Book On Fruits, Vegetable & Food Processing With Canning & Preservation	— " —	Rs. 975/-
15.	Herbal Cosmetics Hand Book	— " —	Rs. 1200/-
16.	Hand Book On Herbal Medicines	— " —	Rs. 750/-
17.	Modern Technology Of Waste Management: Pollution Control, Recycling, Treatment & Utilization	— " —	Rs. 975/-
18.	Hand Book On Modern Packaging Industries	— " —	Rs. 975/-
19.	Modern Technology Of Oils, Fats & Its Derivatives	— " —	Rs. 1100/-
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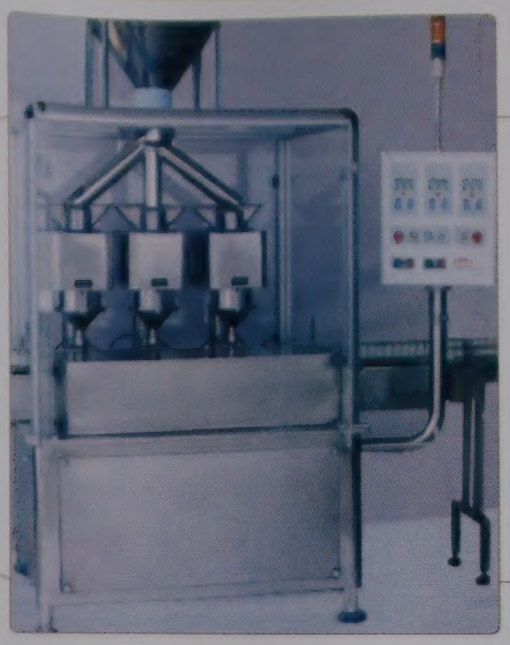

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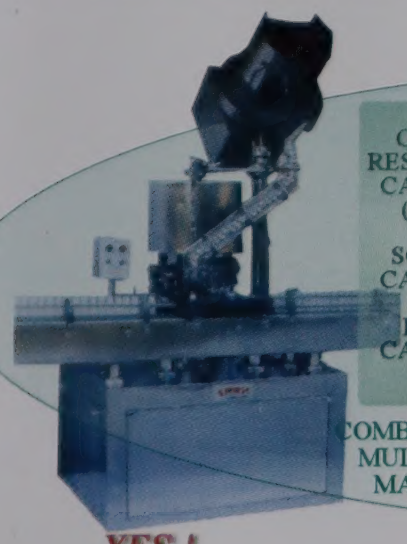

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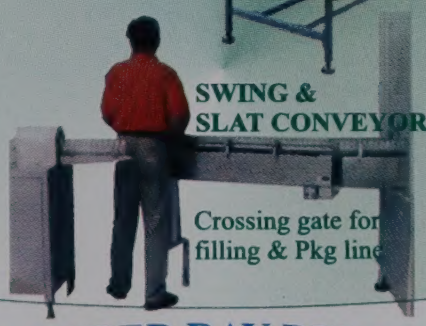

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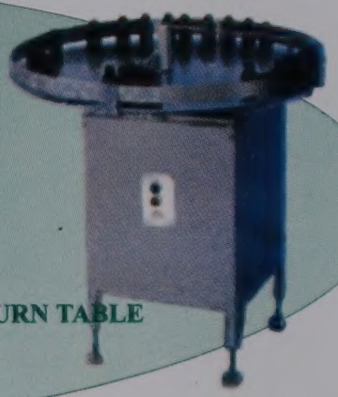

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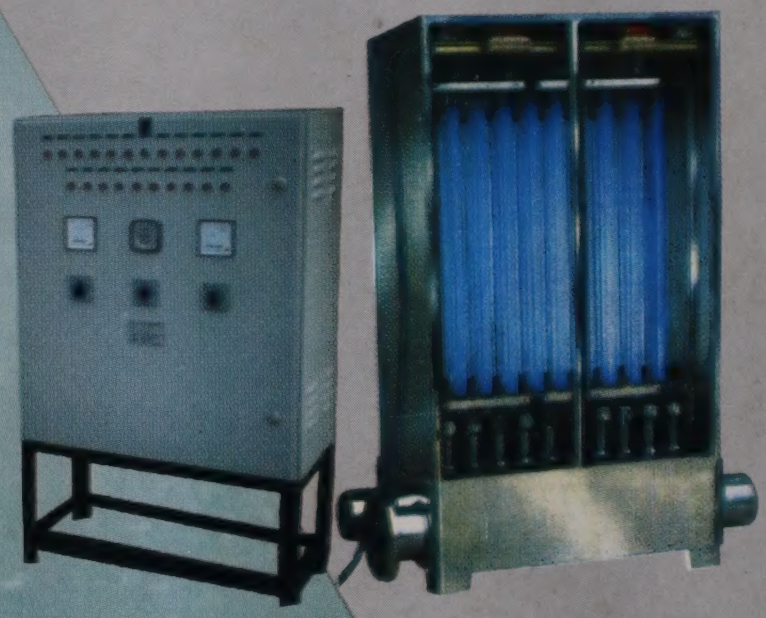

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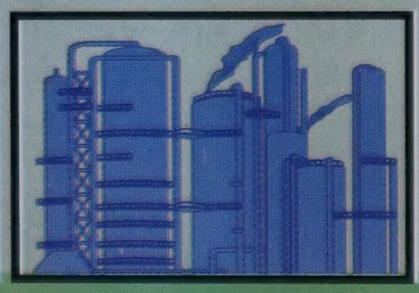


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